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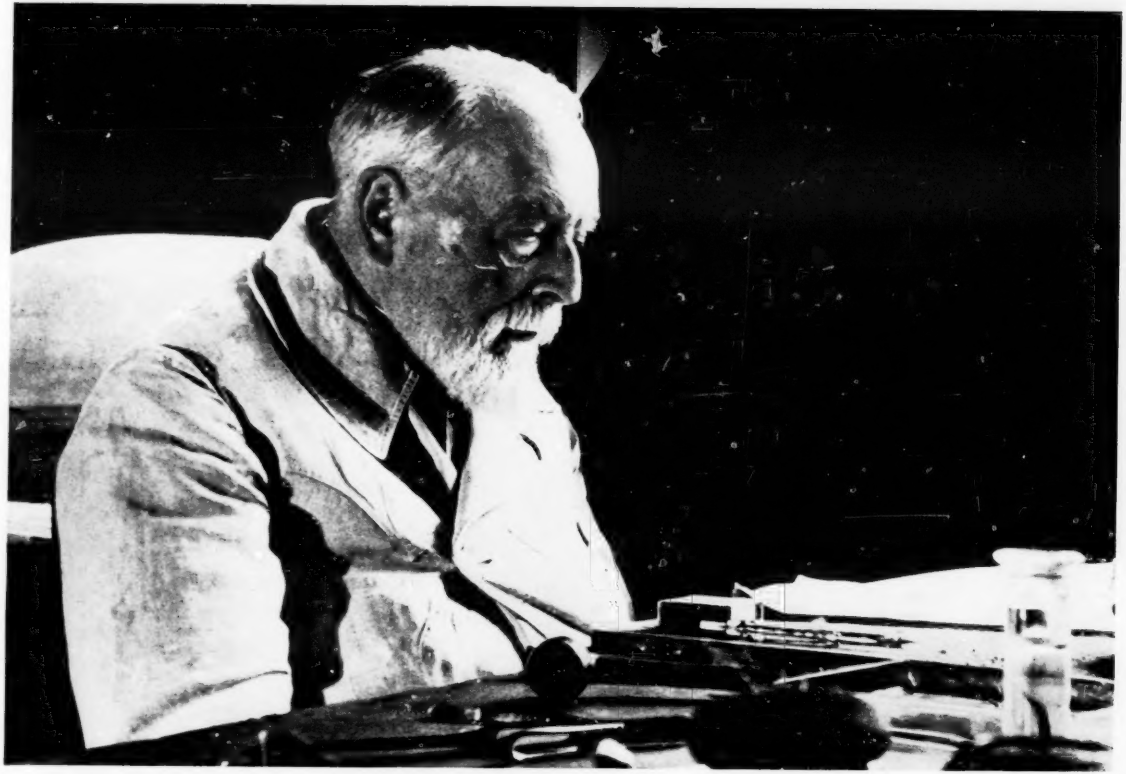

GEORGE ALBERT BOULENGER

George Albert Boulenger, 1858—1937[1]

By Malcolm Smith, M.R.C.S. London

George Albert Boulenger died on November 23rd, 1937, at the age of 79, and although it is 17 years since he published anything on herpetology his name still stands out above all other workers on the subject and seems likely to for many years to come. It was my privilege and pleasure to work with him during his last years at the British Museum, and some recollections of the man himself and his methods may be of interest to readers of Copeia.

I think what impressed me most in conversation with him was his wonderful memory. He seemed able to remember any species he had once seen and every description of a species or article or book that he had once read. If he could not pronounce an opinion at once upon a specimen shewn him, he could almost invariably do so in a very few minutes. His remarkable memory was of course the secret of the speed at which he worked. He wrote with equal facility. Once he had decided what he wanted to say he had no difficulty in expressing himself, and his writings are models of conciseness and clarity. He seldom made a second draft of anything he wrote and the manuscripts of his that I have seen shew but few corrections. They went straight to the publisher. They were never typed and he never employed a typist. When I started correspondence with him I was living abroad and I often wrote and asked him for descriptions of which I had need. The answer invariably

[1] A list of Dr. Boulenger's herpetological and ichthyological publications was published by the Zoological Society of Belgium in 1921. An account of his life, by J. R. Norman, may be found in Nature, 141, Jan. 1, 1938: 16–17. The photograph reproduced as a frontispiece was loaned by Dr. G. F. de Witte, the one above was loaned by Dr. A. G. Ruthven.

reached me by the return mail, copied out, often at considerable length, by himself. French and English were mother tongues to him, and he could converse fluently in German, and read Spanish and Italian. He could read also a little Russian. He had the rare gift of being able to go to sleep at any time and in any place, and this helped without doubt to keep his mental powers always fresh and at their best.

He is best known by his monographs of the amphibians and reptiles of the world, and they stand as a lasting monument to his genius. The first was published in 1882, the ninth and last volume in 1896, when he was but 38 years of age. It was a wonderful achievement but it was by no means his sole work at that time. During those years he produced in addition a continuous stream of short papers and articles dealing not only with his own special subject, but with fishes as well.

To appreciate what he accomplished in those volumes one must realize the state of herpetology when he began them. Gray's and Günther's catalogues formed no doubt the basis upon which he framed his own for lizards and snakes, and for the Amphibia he followed Cope, but his systematic grouping was well in advance of theirs and, except for the Amphibia, has not been successfully challenged to this day. He was a tireless worker during those years. By nine every morning he was in his room in the museum, and he seldom left it, except for lunch, until six in the evening. During the summer months also, while the light was good, he would often return after dinner in the evening and continue until it was dark. Boulenger began his work before the binocular microscope came into general use and he never took to it. All his detailed examination of specimens was made with a small hand lens. He did not do much dissecting but relied chiefly upon prepared skeletons and upon the examination of such internal structures as were easily accessible. His counts of the maxillary and mandibular teeth of snakes, except for the diminutive forms, were quite often done with the tip of the fore-finger. He often missed a few teeth but I am not aware that he made any gross errors. Boulenger has been often criticized for his non-observance of the *Rules of Zoological Nomenclature,* particularly by those who began their work after the rules came into prominence in 1914. A name to him was a definition, a word that if possible should be descriptive of the creature and therefore more easily remembered. I have known him to spend hours hunting for a suitable term, although he had a wide knowledge of both Greek and Latin. His wish to make the word fit the creature was his reason also for refusing to use such names as *Uropeltis philippinus* and *Rana afghana* for species that he knew had never come from those countries. His dislike of tautonymous names was upon grounds of euphony and there is something to be said for it. After all, terms like *Troglodytes troglodytes troglodytes* for the wren, or *Iguana iguana iguana* for the iguana, ring somehow of Stephen Leacock rather than of Science.

His use of the term variety has often been criticized, but he has expressed himself clearly on this point in the introduction to his *Monograph of the Lacertidae.* "Whilst not losing sight of resemblances, I attach the fullest importance to the recognition of minor forms or subspecies, which I designate as varieties, in accordance with the Linnean practice—there be-

ing no need to depart from it." A mere colour variety had no place in his classification.

His great contemporary was Cope and I never heard him express anything but admiration for his work. In their desire to establish the fundamentals of herpetological classification and leave the details to later generations the two men had much in common.

Boulenger loved all animals and all children, particularly those who were interested in nature. And in return he was loved by them all. His power over animals was almost uncanny, and he would take infinite pains to teach children and to help them in anything connected with natural history. On the other hand he had very little use for those scientific workers who lacked what he called the scientific mind, and he did not hesitate to express his opinion of them. He was an only child and until he entered the university of his native town was privately educated. As a small boy he was passionately fond of wild flowers, and these he would gather whenever he could and bring them home to decorate his rooms. When he ended his career at the British Museum at the age of 63, it was to wild flowers, and the study of wild roses in particular, that he turned again, and he maintained this interest to the last.

BRITISH MUSEUM (NATURAL HISTORY), LONDON, ENGLAND.

Notes on *Eumeces anthracinus* in Central New York

By ROBERT T. CLAUSEN

THE so-called coal skink, *Eumeces anthracinus*, formerly considered a great rarity in central and western New York, has been found to be really a fairly common species in certain small areas. Bishop (1918), Wright (1919), and Taylor (1935), have recorded the known distribution of this lizard in the state. In presenting the following notes, I wish to express my appreciation to Mr. S. J. Smith for making his data available to me, and for providing the two living specimens for study, to Mr. Harold Trapido for assistance and suggestions, and to Prof. and Mrs. A. H. Wright for encouragement. Since 1933, at least ten additional specimens have come to my attention. One of these is from Chemung County, and two more are from Bergen Swamp, Genesee County. These last were collected on May 28, 1933, by a party of which I was a member, about wood piles near the edge of the swamp. One of these individuals, kept in captivity by Dr. L. T. Murray, later laid four eggs, but these did not hatch. On May 29, 1937, Mr. Harold Trapido and I saw another individual in the open marl area of the Bergen Swamp, but were unable to capture it. In the Cayuga Lake region, no specimens were seen between April, 1892, and April, 1935, when Mr. F. D. Garret collected a specimen on Connecticut Hill, Newfield Township, Tompkins County, about eleven miles southwest of Ithaca. In 1937, seven specimens were found on Connecticut Hill, all within a radius of three miles and at elevations of from 1400 to 1800 feet. Six of these specimens were caught or observed while running in the open on the slope of the hill in the vicinity of Carter Creek,

while the other was found under a flat stone in the same area. All of these specimens are now preserved at Cornell University.

Figure 1. *Eumeces anthracinus* (Baird). Adult female with eggs and emerging young.

Mr. S. J. Smith kindly gave me two individuals, a male and a female, collected by himself on Connecticut Hill on May 16. These were kept in a terrarium, where it was my privilege to watch courtship, mating, and the breeding habits. The lizards were decidedly secretive, usually hiding themselves under moss or burrowing in the sand on the bottom of the terrarium, although they did occasionally lie out in the open to sun themselves. During

late May, the orange-throated male was often seen chasing the female about, the pair usually moving in circles with the male occasionally grasping with its jaws the tail or the side of its mate. Mating apparently occurred during the last week of May, but the courtship antics were frequently repeated up to the time and even after the first egg was laid on June 29. This first egg was removed and soon proved bad. Four days later, on July 3, eight eggs

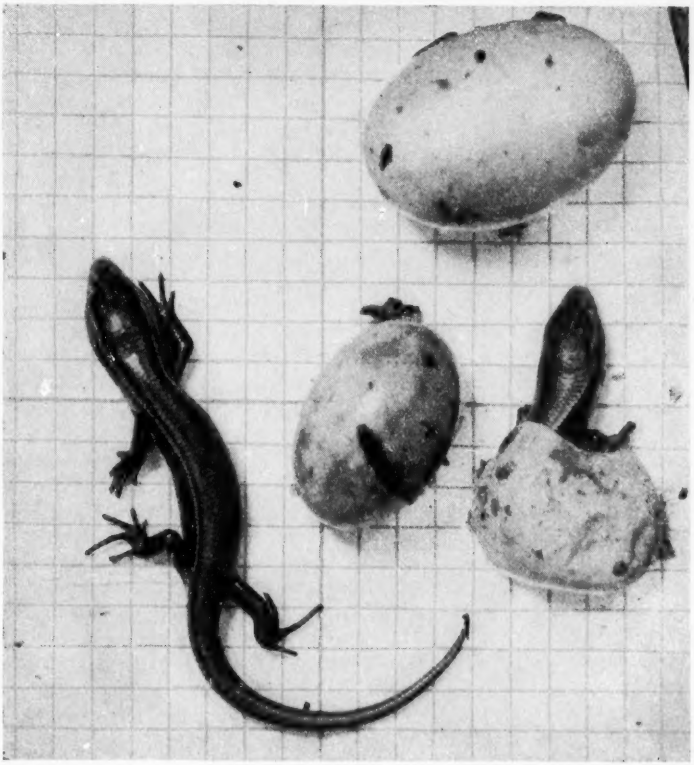

Figure 2. *Eumeces anthracinus* (Baird). Top, egg before hatching; left, young immediately after emerging; middle, egg at the beginning of hatching; left, young half emerged. Small squares represent one-tenth inch.

were deposited under some moss in one corner from which the sand and gravel had been cleared aside by the lizard to form a little depression. From that time until the eggs began to hatch, except for two short intervals, the female guarded the eggs continuously, coiling her body about them and seeming to turn them frequently. When disturbed, she would assume a defensive attitude and snap viciously. In this behavior, my specimen differed from the *Eumeces fasciatus* observed by Noble and Mason (1933), who report that the lizards in their experiments defended the eggs only against small intruders. Through-

out the incubation period, the moss, under which the eggs were laid, was kept rather moist.

At the beginning of the incubation period the male remained for most of the time in the moss above or near the female, but since it refused food from the first, gradually became so weak that it was necessary to kill and preserve it in mid-July. Before egg laying the female took meal worms from a forceps, but for a long period after that she seemed more interested in protecting the eggs than in eating. On August 3, however, she took eighteen small moth larvae, fifteen alive and three dead. These I obtained from a tin of decaying raisins. She snapped at the worms greedily and without coaxing, taking them from the point of a forceps. The dead worms were offered after several live ones had been taken, and she accepted these quite as readily as the live ones. On August 8, she took nineteen more of these worms in rapid succession.

Thirty days after they were laid, on August 2, the eggs averaged 17 mm. long and 11.5 mm. wide, with the extremes in width 11 and 12 mm. The eggs were oblong, grayish white, with soft shells. At this time the female measured 140 mm., of which the tail was 70 mm.

Hatching began on August 9, when, at 7:30 P.M., I observed the first young one emerging from the egg. By 8:35, it had entirely emerged. It was 45 mm. long, of which the tail was 20 mm., and had the same pattern as the adult, but with the tip of the nose and sides of the head orange, the back olive black bordered by a narrow yellow stripe on each side, the side bands and legs deep black, and the tail blue. No other individuals hatched on August 9, but at 7:30 A.M. on the next day three more were emerging, while the female stayed with and continued to turn the remaining four eggs. During the day, two others emerged. Since one of these possessed a portion of the umbilical cord projecting through its abdomen, it moved about with considerable difficulty. The umbilicus had completely disappeared by the next day, when the individual seemed as normal as the others, but showed a prominent umbilical scar, as did another specimen examined. The length of the five young which hatched on August 9 ranges from 47 to 51 mm., the proportionate tail length from .46 to .51. On August 11, the seventh individual emerged, while the eighth egg, which now was noticeably smaller than the others had been, was preserved, since it began to show signs of spoiling.

Since these young coal skinks differ in color from those described by Gloyd (1928), the following detailed color description, using Ridgway (1912) as a standard, has been drawn up by Mr. Harold Trapido:

Gulars and infra-labials white to the level of orbit, becoming iridescent antique green on the throat; underside between fore and hind limbs slate black; limbs and sides of body black; a barium yellow stripe from upper labials to hind limb becoming narrower posteriorly, interrupted at the ear; a stripe from the preocular region extending back over the lateral edge of the supraoculars and to 3 mm. behind the hind limb, ochraceous-orange anteriorly, becoming narrower and ochraceous-buff posteriorly; dorsal surface of head Prout's brown, passing to olivaceous black on the back; tail deep blue-violet.

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BAILEY HORTORIUM, CORNELL UNIVERSITY, ITHACA, NEW YORK.

Studies on Neotropical Colubrinae
VI. A New Species of *Eudryas* from South America

By L. C. STUART

WHILE investigating the well-known *Eudryas quinquelineatus* (Steindachner), sporadic specimens were found to occur among the large series available to me which appeared atypical in pattern and had a distinctly greater number of subcaudals than typical *quinquelineatus*. Further study of these few "aberrant" specimens showed that there exists with *quinquelineatus* a new and closely related species which I now dedicate to my friend Dr. Afranio do Amaral of the Instituto Butantan at São Paulo, Brazil. It will be known as

Eudryas ***amarali,*** new species

TYPE.—An adult female, United States National Museum, No. 22534, collected on Marguerita Island, by Captain Wirt Robinson.

PARATYPES.—Six specimens: U.S.N.M. No. 10137 from Tobago Island; A.N.S.P. Nos. 18286–18287 from Cariquito, Venezuela; and M.C.Z. Nos. 9988, 9989, 9990 from San Antonio de Maturin, Venezuela.

DIAGNOSIS.—Readily distinguished from *Eudryas quinquelineatus* by the absence of dark mottling on the chin and throat, by the fact that the three dorsal dark stripes are fused to form a single broad band, and by the greater number of subcaudals (83–105 in *quinquelineatus* as compared with 110–119 in *amarali*).

DESCRIPTION OF TYPE.—Head scutellation normal. Rostral normal, wider than high, visible from above. Two internasals and two prefrontals; internasal suture shorter than prefrontal suture. Frontal longer than its distance from the end of the snout and shorter than the parietals. Supraoculars as long as the frontal. Nostril between two nasals. Loreal about twice as long as high. One preocular and two postoculars. Temporals 2 + 2 + 2. Supralabials 9, fourth, fifth, and sixth entering the orbit. Intralabials 10, 5 in contact with anterior chin shields, which are only about one-half as long as the posterior. Dorsal scales smooth, with two apical pits; in 17 rows anteriorly

and 15 just in front of the anus. Ventrals 190; anal divided; subcaudals 115. Total length 897 mm., tail length 270 mm.

Dorsally the ground color (*stratum corneum* lacking) is gray-blue. Anteriorly there is a light lateral stripe on scale rows three, four, and five. This is bordered above by a narrow black line on the upper half of scale row five and below by another black line on the lower half of scale row three and upper half of scale row two. This lateral pattern disappears about a quarter way back on the body. Many of the dorsal scales have a narrow black anterior border which is concealed by the preceding scale. Above and laterally the head is olive-brown where the *stratum corneum* is in place and is colored like the dorsum when the *stratum corneum* is lacking. A very faint dark smudge extends from the nostril, through the eye, and across the temporals and upper portions of the posterior supralabials. The supralabials, infralabials and entire underparts are immaculate white, infringed upon by the dorsal ground color at the sides.

RANGE.—The specimens at hand indicate that this species ranges through the dry forests and savannas of eastern Venezuela and on the islands off the north coast. It has not, however, been recorded from Trinidad.

REMARKS.—The presence of only seven specimens of this species in museum collections excludes any comments on variation. The following table indicates the ventral scutellation of the type and paratypes:

Mus. No.		Locality	Sex	Ventrals	Caudals	Ventrals + Caudals
U.S.N.M.	22534	Marguerita Id.	♀	190	115	305
U.S.N.M.	10137	Tobago Id.	♂	193	119	312
M.C.Z.	9988	Maturin, Ven.	♀	183	...	...
M.C.Z.	9989	Maturin, Ven.	♀	196	*ca.* 110	*ca.* 306
M.C.Z.	9990	Maturin, Ven.	♀	193	115	308
A.N.S.P.	18286	Cariquito, Ven	♂	185	117	302
A.N.S.P.	18287	Cariquito, Ven.	♂	185	*ca.* 115	*ca.* 300

The variation may be expressed (averages in parentheses) as: ventrals, 183–196 (189); caudals, 110–119 (115); ventrals + caudals 300–312 (306). Variation in pattern is negligible.

As will be pointed out in a forthcoming paper, simplification of pattern through loss of color seems to be the evolutionary history of the genus *Eudryas*. If this is so, *amarali* has evolved from an ancestor resembling *quinquelineatus*. It may be suggested that this evolution took place on one of the islands off the northern coast of Venezuela while *quinquelineatus* was developing on the mainland. At a fairly recent date it is believed that *amarali* reinvaded the mainland while *quinquelineatus* spread out onto the islands. This argument is based on the fact that *amarali* is known from the mainland, Marguerita Island, and Tobago Island, while *quinquelineatus* has not yet reached so distant a point as Tobago though it is known from both Marguerita and Testigos. That *amarali* occurs on Testigos is quite probable. The absence of both *quinquelineatus* and *amarali* from Trinidad is unexplainable in the light of present knowledge.

MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN.

A New *Agkistrodon* from Mexico

By Benjamin Shreve

In the course of identifying W. W. Brown's interesting latest collection I came across the surprising new species described below.

Agkistrodon ***browni,*** sp. nov.

Type.—Museum of Comparative Zoology, No. 42678, a male, from Omilteme, Guerrero, Mexico, collected by W. W. Brown in 1936.

Paratype.—M.C.Z. No. 42679, with same data and history as the type.

Diagnosis.—This new species does not seem to be closely related to any member of the genus, but seems most similar to the Asiatic *Agkistrodon hypnale,* from which it differs in shape of head, in the arrangement of the head scales, mostly single caudals, and in coloration. Although apparently less similar, *browni* is very likely more closely related to *Agkistrodon bilineatus* from which it differs in shape of head, arrangement of head scales, in a lower number of scale rows, a lower number of caudals, and in coloration.

Description.—Snout rounded, not turned up, flat above, with moderately sharp canthus; rostral broader than deep; internasals broken up into small scales, six in the type, four in the paratype; a pair of prefrontals; a small azygous scale between the prefrontals and frontal (this azygous scale is absent in paratype); frontal as long as its distance from the end of the snout, longer than, or shorter than the parietals (the left parietal, due to fusion with another scale, is longer than the frontal in the type; otherwise the frontal is longer than the parietals); parietals not in contact with each other; upper preocular separated from the posterior nasal by a loreal; two postoculars and one or two suboculars separating the eye from the labials (only on the left side of the type there is one subocular, the other being lost by fusion with the lower postocular); eight upper labials, none forming the anterior border of the loreal pit; scales more or less strongly keeled in 19 or 18 rows at midbody (18 or 17 in paratype; in both examples reduction comes at or near midbody); ventrals 134 (141 in paratype); anal entire; caudals 31 (27 in paratype) mostly single (first, thirtieth, and thirty-first divided in the type; first, eighteenth, and twenty-fourth to twenty-seventh in the paratype).

Coloration in Alcohol.—Above, brown (gray where outer epidermis has peeled off), with many black, or dark brown, narrow, short markings, light edged anteriorly and often, on the mid dorsal line, paired to form chevrons, or else alternate; on the posterior part of tail obscure light bands, black, or dark brown edged; below, black or dark gray, spotted and washed with whitish; lower labials and underside of lower jaw prominently spotted with white; posterior part of tail whitish brown, this coloration extending on to the upper side to some extent (only on under side of tail in paratype).

Measurements.—The type measures 445 mm. in total length, tail 55 mm.; the paratype 359 mm., tail 36 mm.

This surprising novelty is named for W. W. Brown, its collector.

Museum of Comparative Zoology, Cambridge, Massachusetts.

Surgical Removal of the Poison Glands of Rattlesnakes

By John Tait

THE complete removal of the venom glands in poisonous snakes is apparently not a common operation. The writer, who began his attempts to render captive rattlesnakes safe by extracting both the fixed and the reserve fangs, soon discovered, as others had found before him, that this procedure is usually followed by a mouth infection, to which the animals succumb in spite of all subsequent efforts at disinfection of the wounds. Consequently the safer but more elaborate operation of taking away the poison glands was devised. The purpose of deglanding the snakes was to render them more readily amenable in physiological experimentation.

A certain amount of technical equipment is necessary for the operation; also the help of an assistant to bind the snake, to act as anesthetist, to prepare the tray of aseptic instruments, to hand ligatures, etc.—for only the operator need have his hands sterilized. Were one to work single-handed, one would employ a water-soluble anesthetic, e.g. dial or nembutal, by means of which the subject may be rendered and kept inert for long hours on end. It is only because rapid recovery of the animals was desired that volatile anesthetics were in general preferred to those whose action is longer lasting.

The snake is placed at first in a glass-covered box containing dilute chloroform vapor. There it is left for a matter of twenty minutes to three-quarters of an hour. After its head has drooped and it has ceased to respond to prodding stimulation, but before its body has become limp and lost its tone, it is laid lengthwise on a flat board placed on a narrow animal table. With strips of sticking-plaster, arranged at intervals athwart its body and secured to the wood with thumb tacks, the subject is "gullivered" to the board. If the snakes are of uniform size, any one of them can equally well be held by being dropped, tail first, into a brass tube of suitable diameter and of a length sufficient just to leave the head and neck and the muscular part of the tail free at the ends. A transverse bar of metal soldered to the tube keeps it from rolling. With this device it suffices to apply sticking-plaster only to the neck and to the tail. At all times, but particularly when the subject is a large and powerful one, it is necessary to give careful attention to the fixing of the neck. A glass tube, connected to a rhythmically acting air-pump and ether bottle, is then inserted into the trachea. The sides and top of the head are next painted with tincture of iodine. The tracheal tube is momentarily removed, and the area of operation covered with a dry sterile cloth so slit as to allow only the head to protrude. On second insertion of the tracheal tube, this time on top of the sterile cloth, the animal is ready for operation.

The depth of anesthesia is gauged at intervals by observing (1) any spontaneous bodily movements, (2) reflex withdrawal of the tongue when it is grasped with forceps, (3) reflex coiling of the tail when the area of black skin at the base of the rattle is tweaked. In general the anesthesia is so adjusted as to abolish all spontaneous movement and yet leave the former of these two reflexes present. Total abolition of the tongue reflex means unduly deep anesthesia. As in any surgical operation, sudden cessation of hemorrhage at any stage is an indication that the circulation is failing from overdosage

with anesthetic, the treatment for this being artificial respiration without ether. Contrariwise, bleeding, however slight, means that the snake is alive.

It should here perhaps be mentioned that a turgid venom gland is much easier to isolate by dissection than the same gland collapsed. Consequently the glands are not milked of their poison prior to operation.

The instruments and other operation materials required are:

one pair fine-pointed ("splinter") forceps;
one pair small, blunt-pointed ("strabismus") scissors;
one pair small, fine-pointed scissors;
four pairs fine (Halsted's "mosquito") artery forceps;
one combined seeker and ligaturing needle (straight), *or* one Deschamp's ligaturing needle (curved);
two Dieffenbach ("bull-dog") forceps;
one straight surgical needle;
fine catgut, size 00;
black silk thread, sterilized;
dry sterile swabs.

The skin of the cheek, pinched up with the splinter forceps, is first snicked to allow entry of a blade of the strabismus scissors. A straight cut is then carried from a point just above the angle of the gape almost to the pit. In cutting, care is taken to keep just halfway between the edge of the mouth and the eye. This precaution is necessary for ease of subsequent suturing. The upper flap of skin is now freed, by tearing or by snipping of its loose subcutaneous attachments, and thrown medially over the head with the two bull-dog forceps. The lateral border of the gland, invested in its strong, white, fibrous sheath, is discovered at once on pulling the lower flap downwards. Anteriorly, below the eye and near the pit, the gland ends in its S-shaped duct. Posteriorly, near the angle of the gape, it is attached by a long, superficial, backwardly coursing, tendinous band, which, shining white against darker muscle, can be readily recognized, isolated and neatly gripped with artery forceps close to the gland, whereupon the band may be divided posteriorly. One has thus obtained the first hold by which to apply traction to the gland.

On its lower aspect the lateral part of the gland is bound by multitudinous fibers of connective tissue to the mucous membrane of the roof of the mouth. As these fibers are longer and less dense posteriorly than anteriorly, the easiest way now to proceed is to work from behind forwards and so eventually to free the gland from the underlying, oral, mucous membrane. Until one has acquired some degree of experience, however, in assessing and maintaining a proper anesthesia, it is certainly advisable now to turn forthwith, if not from the very beginning, to the more difficult region of the duct and, keeping one's hands at forceps- or scissors-length, to isolate that with the intention of securing it in mosquito forceps. The duct, very tough and strong, can fortunately bear rough handling. Attempts to snip it free are not advisable because of the yielding nature of the tissues and because of the presence of a large, concealed accompanying artery. It is best isolated by forcibly pushing the closed fine scissors from above downwards, between it and its attachments, inclusive of those to the skin. Once the points have penetrated, the blades of the scissors are opened out so as to furnish some available length of free duct. When the duct has once been properly clipped in forceps (close to the gland), one knows that the poison-fang on that side of the head at least can do no effective damage. Presuming, however, that we are following the order of operation as conducted on a snake known to be well anesthetized, we shall return later to the treatment of the duct.

Posteriorly it is easy to free the gland from the oral mucous membrane, less easy anteriorly. While pulling the skin and mucous membrane downwards, one should snick with the points of the strabismus scissors directly upon the tough gland-covering. If the scissor-points are directed to what may seem a loose region of union between the two components, the thin and tightly adherent mucous membrane is likely to be buttonholed. The accident, if it does occur, is trivial enough, for the wound can later be stitched with silk thread from the oral side, so that the knot or knots protrude into the mouth. Thus the ligature can be readily removed after healing. The disadvantage of buttonholing is not

so much the risk of subsequent sepsis; it unnecessarily delays and complicates the operation itself. By snicking consistently upon the fibrous covering of the gland the writer has never yet ruptured it from below, though in his early attempts he did once or twice open the gland from above.

Though the binding connective tissue is denser near the anterior part of the gland, the duct finally begins to show up quite clearly. It is then isolated and secured as previously described. After the artery forceps are applied, the seeker (or the Deschamp's needle) is passed from below upwards, threaded with catgut and again retracted, so that (with fingers or with forceps, according to circumstances) the catgut may be tied close to the root of the fang. The reason for tying the duct is simply that an artery joins it on its deep aspect and the ligature prevents haemorrhage. Whether tied or left untied, regeneration of gland substance from the stump of the duct never occurs. So soon as the duct is divided between the catgut ligature and the mosquito forceps, one has a second hold by which to exercise traction on the gland. Should inconvenient haemorrhage ever arise near the base of the fang, it is best controlled by grasping the bleeding point with mosquito forceps and twisting it round and round. All the parts in this neighborhood are firm and can stand hard treatment.

One now turns to the upper aspect of the gland, to which a flat compressor muscle is closely applied. This "dorsal" compressor arises medially and posteriorly. Its fibers spread fanwise from the origin to a ribbonlike insertion which winds along the lateral margin of the gland to the whole of its upper anterior surface. Thus, if an opening is expertly made with fine scissors through the posterior part of the ribbonlike insertion, the strabismus scissors can then be slipped between the muscle and the gland and bloodless detachment of the muscle (except perhaps in its very anterior and medial part) is easy.

When it is lifted up and thrown back towards its origin, a broad, horizontal ligamentous band is discovered binding the medial border of the gland to the central cranium. One blade of the strabismus scissors is passed beneath this band and close to it, and the ligament is snipped, whether at one sweep or by successive nibbling. The band is toughest and most hidden in its posterior half, but often enough the scissors can be introduced from behind and carried forward. When it is completely divided, the loosened gland can for the first time be dislodged laterally.

It is still attached of course by its nerves and blood vessels; fortunately also by a cylindrical "ventral" compressor muscle, which, coursing from its bony origin near the eye, runs backwards to its insertion on the deep aspect of the gland. Because of the presence of this muscle there is little or no risk of the gland being torn away by accidental pull of the two pairs of attached metal forceps. It saves the delicate blood vessels from rupture.

The whole object of the previous procedures has been so to free the gland on every quarter that it hangs like a mushroom on this central stalk consisting of ventral muscle, blood vessels and nerves. If its periphery is still attached at any point, these hitherto overlooked bonds anteriorly, posteriorly or laterally are snicked until the stalk is fully displayed. A catgut ligature is now passed round the stalk and tightly tied. Then, working close to the ventral fibrous covering of the gland, one detaches it with scissor snips from the ligatured stalk.

The skin wound is now closed by purse-string suture with silk thread. As the free edges of the skin are prone to roll inwards, care must be taken during the stitching to bring wet, not dry, surfaces into opposition.

Working at top speed after considerable practice, the writer has on two or three occasions reduced the time for the double operation to less than twenty-one minutes, though he has never actually finished in twenty minutes. With skilled assistance one can practically reckon on doing five successive snakes in the space of three hours, exclusive, however, of the time of the first chloroform anesthesia and of the fixing of the first animal to the table. The operation has been carried out on large western diamondbacks and on prairie rattlesnakes of different sizes down to eighteen inches in length. It could easily be effected on still smaller specimens, provided only that a sufficiently

fine needle were used for suturing the skin. If the anesthesia is good, the mortality on the table is nil.

The skin wounds heal readily. Out of a tally of some one hundred and twenty operated animals lethal sepsis has never occurred. The stitches may be removed after a fortnight. Only in cases where the snake has moulted in the interval, have the skin edges parted again on attempted removal of the sutures. It has recently been found, too, that for the deep ligatures silk thread may with perfect propriety be substituted for the more expensive catgut.

The operation produces of course an alteration in the configuration of the head, which, losing its triangular contour, becomes narrow like that of poisonous colubrine or of innocuous snakes. Loss of the venom glands has no apparent effect upon the temper or the health of the subjects. Frequent scratches or deep bites inflicted by deglanded animals have not had any septic consequences. It was of interest to find that removal of the glands has no effect upon maintenance or upon successional replacement of the fangs. Evidently fang growth and fang attachment are controlled independently of the associated poison sacs. Still another point of interest is that in one or two of the early trials at deglanding, the poison sac was incised and venom flowed freely into the open wound. The venom was swabbed away, it is true, but the animals took no apparent harm from being deluged with their own poison.

It has been mentioned that the snakes are not milked of poison prior to operation. From the exsected glands the poison can be easily and cleanly collected. The posterior pair of mosquito forceps having been detached, the gland is washed in Ringer's fluid in order to moisten or remove any adherent blood. It is then wiped dry and clean by being pulled over a surface of paper. When now the anterior pair of forceps is detached, the poison may either at once stream out under digital pressure or, if the duct has become locally blocked by the compression, it will escape when the crushed portion has been detached with scissors.

In conclusion the writer would like to express his gratitude to Mr. R. H. Coe, of Winner, South Dakota, for two large consignments of prairie rattlesnakes kindly crated and forwarded to him free of charge. Without the skilled help, too, of his assistant, Mr. James Evans, the facility with which the operations could be done would have been very different.

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Unusual Defense Postures Assumed by Rattlesnakes

By Raymond B. Cowles

THE habitual attitudes assumed by rattlesnakes when they find themselves in the presence of man or some of man's domesticated animals have been repeatedly described and figured, and are familiar to every American herpetologist. The defense posture is so fundamentally similar in all of the species of rattlesnakes in the southwestern United States that any deviation from the normal is at once noticeable.

Defense Reaction of Rattlesnakes Toward King-snakes

In the laboratories of the University of California at Los Angeles we have repeatedly observed that in the presence of our local king-snake, *Lampropeltis getulus californiae,* the rattlesnakes *Crotalus viridis oreganus* and *Crotalus cerastes,* the species that have been most frequently available, depart from the normal postures of defense and assume a remarkable attitude. This consists of the formation of a broad loop or bend in the body which is then lifted from the ground. Approximately one-fourth to one-third of the body can be elevated from this position, and the loop is then used as a human being would use an elbow in striking a heavy blow. As the snake approaches, the rattlesnake strikes downward with such force as to render the blow a very effective defense mechanism. It is entirely conceivable that a snake, so struck, might be seriously injured. In the laboratories, however, we have not had any cases in which there have been any obvious injuries, although many of the specimens which we have observed being struck by these blows have become effectively intimidated and would not subsequently approach the rattlesnake. This use of a part of the body for striking a blow is apparently a substitute for biting. The normal use of the fangs and teeth is not entirely abandoned, for at the last moment in a battle between king-snake and rattlesnake, if the opportunity occurs, the rattlesnake does not hesitate to imbed its fangs in its captor. This final use of fangs has been observed repeatedly, but the king-snakes only occasionally relinquish their hold after having been bitten. In most instances they completely ignore the fangs or flinch slightly and proceed with their feeding, even though the wounds apparently penetrated deeply into the body.

It appears probable that the most effective defense of the rattlesnake lies in this striking of heavy blows with a loop of the body. When this defense proves unsuccessful most rattlesnakes retreat as fast and as far as possible, and when cornered usually coil in such a fashion as to hide the head below several loops of the body. When in this position, if touched by the head of a king-snake, they will jerk their coils spasmodically in attempts to push off or fend away the head of the attacking snake.

The king-snake kills its victim by a combination of several methods, namely, by pulling on the head which is held in the mouth of the captor, by constriction of the heart and viscera, and by suffocation.

Although the rattlesnake frequently resorts to the injection of venom in an attempt at self-defense, in no instance has the king-snake suffered serious damage although there has been at times a slight indication of injury and discoloration at the site of the punctures. Subsequent to these observations, king-snakes were subjected to varying dosages of the venom of the Pacific rattlesnake, in which the full amount of extractable venom was injected subcutaneously and intramuscularly by hypodermic into a king-snake. In other experiments rattlesnakes of large size were induced to bite king-snakes. In no instance has a king-snake suffered materially, nor has there been indication of more than a temporary, local irritation following the bite. This does not seem to be a unique attribute of the king-snake, for during the past few years experiments have been conducted in which most of our local species of harmless snakes have been injectd with varying amounts of venom of the Pacific rattlesnake, *Crotalus viridis oreganus,* and they have

neither succumbed to, nor shown serious injury from, the normal amounts of venom produced by this species of rattlesnake. The only local species of snake upon which we have not experimented is *Lichanura roseofusca*. It may be noted that our local lizards readily succumb to an equal (not proportional) dosage of venom. This may be a result of weight-to-venom ratio, and requires further investigation.

This ophidian immunity to the venom of the rattlesnake does not explain the apparent reluctance of most individual king-snakes to capture a rattlesnake, which I believe to be due to fear of the rattlesnake's blows with a coil of the body.

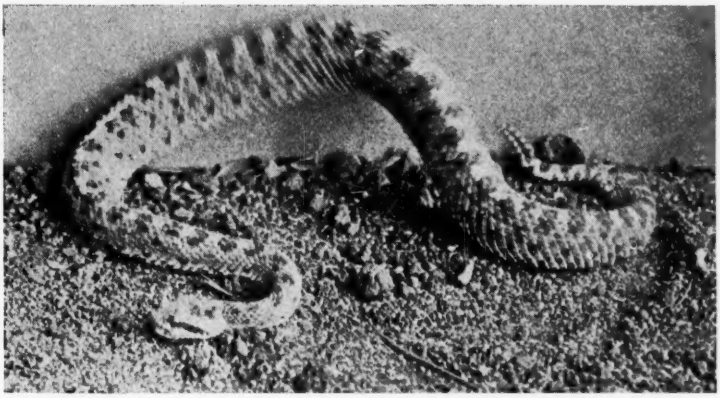

Fig. 1. *Crotalus cerastes* in the attitude assumed prior to striking a body blow.

King-snakes of the species under discussion seem able to identify rattlesnakes either by sight or by smell. Discrimination between species of snakes was shown when a king-snake was "deluded" into an attack on a rattlesnake. A small gopher-snake was inserted in the pen with the king-snake which at once developed an interest in the small individual, captured it and swallowed about half of its victim. The gopher-snake was then liberated, and a small sidewinder, approximately the same size as the gopher-snake, was placed in the pen in its place. Although previously the king-snake had exhibited no sign of interest in this individual, it now approached recklessly, apparently responding only to a visual stimulus, seized the rattlesnake, and although promptly bitten by it, continued to swallow its victim.

Defense Reaction of Rattlesnakes in the Presence of Skunks

In connection with the peculiar behavior pattern of rattlesnakes in the presence of king-snakes, it may be worth while to mention here a somewhat similar behavior under other conditions. In 1934, while a spotted skunk, *Spilogale phenax phenax*, was being skinned, a rattlesnake in a cage in an adjoining room, to which the door was tightly closed, commenced rattling at about the time the scent from the skunk might have been expected to penetrate from one closed room to the other; in other words, within a matter of two or three minutes. This unexpected rattling was particularly notable since

the specimen involved had been in captivity for over a month, and during this period had shown an unusually docile and quiet disposition. This may have been due in part to the fact that the room in which it was kept was partially darkened, but even in the open the specimen was unusually quiet. On receiving the stimulus which I assume to have been the odor of the skunk, it commenced a vigorous and prolonged rattling. When approached by the person who had been skinning the skunk, the rattlesnake did not coil in the usual fashion, but lifted a portion of the midbody in a loop and struck with it repeatedly toward the source of the odor. The usual defense was abandoned in favor of these blows. Repeated experiments with the skin of the spotted skunk, on which there has been placed either fresh oil or preserved skunk oil, have produced the same reaction when brought near a rattlesnake, that is, a reluctance to coil and strike, and the utilization of a loop. These reactions were obtained in *Crotalus cerastes* as well as in *Crotalus viridis oreganus*.

Owing to this demonstration of an unusual defense mechanism, it was thought that the spotted skunk might feed habitually on rattlesnakes when these were available. As soon as a spotted skunk could be obtained for experimentation, it was presented with a live but defanged *Crotalus cerastes*. The skunk approached the rattlesnake without any sign of hesitation, seized it a few inches back of the head, and was promptly bitten in the face, but continued eating the snake. The only skunk available for these experiments was a pet which had been deodorized, and lent to us with explicit instructions that it should not be subjected to any danger. Owing to the difficulties inherent in handling skunks, we have been unable to determine whether or not *Spilogale phenax phenax* will ordinarily attack a rattlesnake, and if so, whether it is immune to the venom of our local species of rattlesnakes, or whether it relies on its dexterity, or spray-gun, to avoid damage. It is hoped that a "natural" skunk and a favorable locality will permit of further study.

To obtain further observations under normal conditions, a robust and active rattlesnake, which rattled on the slightest provocation, was taken to Pasadena to the home of a person who has been feeding the local population of wild striped skunk, *Mephitis o. occidentalis*, for a number of years. Here there is available in the evening soon after sunset a population of skunks living under approximately normal conditions. The rattlesnake was placed in a wire cage near the skunk's feeding box, and the observer retired behind a window to watch for results. Within a few minutes the first skunk of the evening appeared at the feeding place, and without any apparent concern began to search for food. At the close approach of this skunk the rattlesnake rattled vigorously, with the surprising result that the skunk left the vicinity in precipitate haste. During the subsequent hour, this behavior on the part of several skunks was repeated a number of times. It should be noted that these skunks were of a different genus and species than those which had elicited the peculiar "body blow" response from the rattlesnake under laboratory conditions. Opportunity for additional experiments has not been available, and it is hoped that these notes may stimulate others to further observation.

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Notes on Salamanders of the Family Hynobiidae

By Paul V. Terentjev

In 1923 E. R. Dunn published a monographic description of the salamanders of the family Hynobiidae. Many forms belonging to this family are met with in Russia, and Dunn, having no opportunity of studying the materials in Russian museums, could not solve all the problems involved. In the present communication I state my opinion, founded on a study of the collection at the Zoological Museum, Leningrad, Academy of Sciences of U.S.S.R., on some of these problems.

Hynobius turcestanicus Nikolsky

Professor Nikolsky in establishing this species (1918: 246) states that the only known specimen is kept in the Cabinet of Comparative Anatomy, of Moscow University. This specimen has been sent by Professor Menzbier to the Zoological Museum, Academy of Sciences of U.S.S.R., where I have examined it. From information given by Prof. Nikolsky (*loc. cit.*: 245), it appears, though he does not mention it, that there is a second specimen of *H. turcestanicus* (No. 2404) in the Museum of the Academy of Sciences, since it is illustrated on a plate at the end of his book (Nikolsky, 1918: pl. 4, fig. 4).

Dunn suggests (1923: 461) that *H. turcestanicus* and *Ranodon sibiricus* should be carefully compared because of their similarity in coloring and habitus. Having examined both of the above specimens I compared them with a large series of *Ranodon sibiricus*, and find that the palatal teeth and characters of the body show that they belong to *Hynobius*, Dunn's remark on the similarity of the two forms being due to the poor reproduction of the photograph of the larval specimen, No. 2404.

The general aspect of the animal is so reminiscent of *H. keyserlingii*, and the coloration of the adult specimen is so much like that of a specimen of this species (No. 144) from the Shilka River, collected by Popoff in 1854, that, notwithstanding some small differences, I would be much inclined to consider *H. turcestanicus* a monstrous five-toed race of *H. keyserlingii*, suspecting there had been some blunder in the labels and that the specimens in question had not been taken in Turkestan. However, the late Prof. P. P. Soushkine told me of having seen the collectors of both typical specimens, which sets at rest all doubt regarding their locality. All this leads to the conclusion that *Hynobius turcestanicus* is a valid species.

While my measurements of *H. turcestanicus* vary slightly from those given by Nikolsky, this may be explained by a difference in methods of measuring, and by the present poor state of preservation of the two specimens; they are as follows:

Type (adult), Russian Turkestan, between Pamirs and Samarkand.

	mm.		mm.
Total length	91.0	Width of head	8.5
Length of head	11.0	Length of tail	38.7
No. 2404 (Larva), Turkestan.			
Total length	62.7	Width of head	9.0
Length of head	8.5	Length of tail	31.8

Dunn supposes that Nikolsky's genus and species, *Turanomolge mensbieri*, described from Turkestan, may not belong to the family Hynobiidae, and that it may be the larva of *Neurergus crocatus*. Nikolsky's figure of the palatal teeth is found on examination of the type to be very inaccurate, the specimens being much damaged; in No. 2626 the bones of the palate are broken. A careful examination makes it most probable that this specimen should be referred to *Hynobius turcestanicus*. Its measurements are as follows:

	mm.		mm.
Total length	60.5	Width of head	6.3
Length of head	6.5	Length of tail	28.6

Hynobius cristatus Andersson

Dunn suspects that the specimen collected by Souprounenko on the island of Sakhalin in 1890, and referred by Nikolsky to *H. keyserlingii* (our No. 1941), belongs to the above species. My examination of the specimen, which is unfortunately dried out, shows that it differs from *H. keyserlingii* by very few characters. The distinguishing characters of *H. cristatus* given by Andersson (1917: 5), longer tail and head in comparison with the body, when compared with the following analysis of the measurements of *H. keyserlingii* given by Dunn (p. 467) throws doubt on the validity of *H. cristatus*. The proportion resulting from dividing the length of the body by the length of the tail, in *H. keyserlingii*, varies from 1.40 to .75, averaging 1.05. This proportion in Souprounenko's specimen is 0.88, and one of Andersson's is 0.74. Nor do I find other characters to distinguish the supposed *H. cristatus*. The measurements of the specimen in question are:

	mm.		mm.
Length of head	12.4	Length of tail	48.0
Length of body	42.2	Length of forelimb	17.2

Onychodactylus fischeri (Boulenger)

After examining the type of *Onychodactylus rossicus* Nikolsky, I agree with Dunn's conclusion that this species is identical with Boulenger's *Geomolge fischeri*. The measurements of the type, No. 2440, a half-grown larva, are as follows:

	mm.		mm.
Total length	70.6	Width of head	6.9
Length of head	8.7	Length of tail	33.2

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Academy of Sciences, Leningrad, U.S.S.R.

The Genetics of *Xiphophorus hellerii*: Heredity in Montezuma, a Mexican Swordtail Fish

By Myron Gordon

IN the aquaria of tropical fish breeeders and dealers there are two kinds of swordtails, both known by the common name of "montezuma." One of these is a large, tropical swordtail-like fish (*Xiphophorus hellerii*). It varies in color from light orange to deep orange red and is definitely, though variously, spotted with large black dots. The latter are formed by macromelanophores (Gordon, 1927) and are arranged in a variable number of rows along the lateral line. For reasons which will be explained shortly, this fish will be called the "montezuma variety" of the swordtail (*Xiphophorus hellerii*).[1]

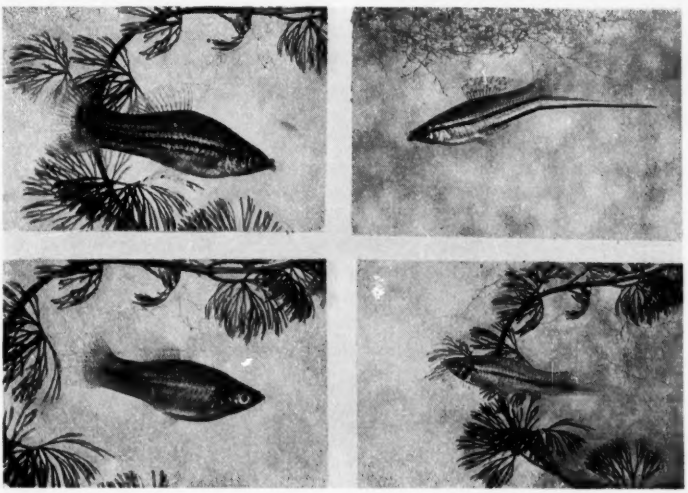


Fig. 1. The Swordtails, *Xiphophorus hellerii*
Upper left, *Mo St*, "Montezuma" female (red, black-spotted and stippled).
Lower left, *Mo st*, "Montezuma" female (red, weakly black-spotted).
Upper right, *mo St*, Stippled or wild type male (stippled only).
Lower right, *mo st*, Golden male (non-montezuma, non-stippled).

The other swordtail is certainly a distinct species (*Xiphophorus montezumae*). In color it is characteristically brownish-olive and dull in appearance, though a few exceptionally brilliant males have magnificent lemon-yellow dorsal fins. The species was first discovered in Mexico by Jordan and Snyder in 1899. Meek, in 1902 (1904), rediscovered it but did not bring any living specimens to the United States. While there have been reports, chiefly by Brüning of Germany, that this fish had been exported, we now know that it

[1] Recent figures of the "montezuma" variety of *Xiphophorus hellerii* have been presented by Kosswig (1933, 1935), Peters (1934), and Innes (1935).

was unknown to aquarists until 1932. In that year, the writer was fortunate enough to catch and successfully transport to the United States many pairs of living specimens from their homes in Río Axtla in the State of San Luis Potosi, Mexico. Since these specimens were taken from the same river system, the Río Panuco, recorded for the type specimens, and since they agree in structure with the type specimens, there can be no doubt of their identity.[2]

Although *Xiphophorus montezumae* seems to be not so hardy as the other swordtails, the stock has been maintained for four years.

History of the "Montezuma" Variety

In 1913, P. J. Arnold described and figured an usually large immature male swordtail which he had obtained from Herr Kuntzschman, a tropical fish dealer in Hamburg. The fish's colors are recorded as brilliant yellow-green on the body, darker above, and golden-yellow below. There are four to five zig-zag lateral lines, the fifth breaking up into a series of black dots. This fish, the dealer reported, had come directly from Mexico, together with three females which Arnold did not see but which were said to be similar to the male. The sailor who brought the fish to Germany said they had been "caught in a small, very muddy pond in Southern Mexico, in the neighborhood of Coatzacoalcos." The locality stated is significant, for it immediately precludes the possibility that the fish was *Xiphophorus montezumae* as Brüning later suggested (see Mecklenberg, 1916). Arnold (1913) first designated it *Xiphophorus* species ?; later (1914) he identified it with *Xiphophorus brevis*, a name created by Regan (1907) for the swordtail of British Honduras. This fish is not regarded as a distinct species today, however, but as a subspecies of *Xiphophorus hellerii*, members of which are often black-spotted. It appears that Arnold was correct in his identification and Brüning incorrect.

Brüning (1914) based another diagnosis of *Xiphorphorus montezumae* on a swordtail from southern Mexico represented in a drawing by Thumm. Although Thumm's fish was considered by the famous tropical fish expert, Herr Härtel of Dresden, as the spotted form of *"Xiphophorus brevis,"* Brüning said that he could not reconcile the measurements obtained from Thumm's drawing with those of the *"Xiphophorus brevis"* given by Regan. Obviously, Brüning was hardly justified in naming Thumm's swordtail *Xiphophorus montezumae* on the the basis of a drawing. Not many of the early pictures of the swordtail are accurate, either in gross anatomy or in the many small details that are of importance for taxonomic purposes (see Table I). It is not surprising, in light of the publicity that Brüning, then the editor of the *Wochenschrift*, and others (Struve, 1917, in Germany, and Poyser, 1919, in America) gave to the name *Xiphophorus montezumae* that this name stuck to one fish that came originally from Coatzacoalcos, as well as to another from southern Mexico. But neither of these fishes could belong to *Xiphophorus montezumae* because that species lives in the mountain streams of San Luis

[2] The figure which Jordan and Snyder (1899) furnish for *Xiphophorus montezumae* shows the male fish with a notched dorsal fin. This drawing must have been made from a mutilated fish, for most of the specimens in the original Jordan and Snyder collection, preserved in the Natural History Museum of Stanford University, have normal dorsal fins. Recent discussions of *Xiphophorus montezumae* have been presented by Kosswig (1933, 1935), Peters (1933), Stoye (1933), Gordon (1933), Mayer (1934), Friedman and Gordon (1934), and Innes (1935). Gordon (1933) describes the circumstances under which examples of the species were caught and also their aquatic homestead.

Potosi, rarely reaches the lowlands, and does not occur outside the Rio Panuco drainage area.

When in 1932 the real *Xiphophorus montezumae* was collected in San Luis Potosi and examined, it was clear that it was not identical with the "montezuma variety" of *Xiphophorus hellerii*. Recent writers on aquarium fishes are agreed on this matter, namely Stoye (1933), Mayer (1934), Peters (1934), and Innes (1935). It is said also that the old aquarium "montezuma" is a hybrid of indefinite origin. Some tentatively suggest it to be the product of a hybrid between *Xiphophorus hellerii* and *Platypoecilus maculatus* (the red and black spotted variety known as *rubra*), back-crossed to *Xiphophorus hellerii*. When such a breeding procedure is followed, however, the "montezuma variety" is not produced, but hybrids with melanotic tumors. Furthermore, when the first generation tumorous hybrids are back-crossed to *Xiphophorus hellerii*, the black pigment cells that characterize the melanotic fishes are intensified to still greater degree in the back-cross hybrids, with the result that earlier and more malignant types of melanotic neoplasms are produced (Gordon, 1931, 1937.2). On the other hand, when the red, black-spotted "montezuma" is crossed with *Xiphophorus hellerii* no tumors appear in the offspring, and the black spots characteristic of the "montezuma" are not increased in numbers at all. It will be shown in this paper that there is a tremendous *loss* of black pigment cells (macromelanophores) in certain "montezuma" members of a brood when a normal "montezuma" is crossed with a golden swordtail. The latter is a variety of *Xiphophorus hellerii* that lacks both large and small melanophores, the history of which has recently been presented (Gordon, 1937.3). If a red, black-spotted platyfish is crossed with a golden swordtail, melanotic tumors result in the offspring (Gordon, 1937). From these experiments, it appears that the "montezuma" swordtail is not the product of an intergeneric mating.

TABLE I

EARLY HISTORY OF THE NAME "MONTEZUMA" AS APPLIED TO A VARIETY OF SWORDTAIL, *Xiphophorus hellerii*, RECORDED IN "WOCHENSCHRIFT FÜR AQUARIEN UND TERRARIENKUNDE"

Origin of Fish	Aquarist	Artist	Author	Fig.	Vol.	Page	Year	Diagnosis
1. Coatzacoalcos	Kuntzschman	Arnold	Arnold	1	10	233	1913	*X.* species?
"	"	"	"	3	11	126	1914	*X. brevis?*
"	"	"	Brüning	2	13	274	1916	*X. montezumae*
2. So. Mexico	Härtel	Thumm	Brüning	3	11	470	1914	*X. montezumae*
"	"	"	"	3	13	275	1916	Hybrid *X. helleri* by *montezumae*
"	"	"	Struve	2	14	23	1917	*X. montezumae*
3. Unknown	Unknown	Brüning	Mecklenberg & Brüning	1	13	273	1916	*X. montezumae*
"	"	"	Struve	1	14	23	1917	*X. montezumae*

PROBABLE ORIGIN OF THE "MONTEZUMA VARIETY"

The black spotting in the "montezuma variety" of *Xiphophorus hellerii* may be compared with similar patterns in *Platypoecilus variatus*, *Platypoecilus xiphidium*, and in *Xiphophorus montezumae*. In all these species, there are individuals which have many large black spots arranged in several

lateral rows. It is suggested that the present day "montezuma" is a derivative of a black-spotted form of the common swordtail, *Xiphophorus hellerii*, and had its origin in Mexico, as did similar varieties of other xiphophorin fishes. Black-spotted forms exist in the swordtails of southern Mexico and British Honduras according to Meek (1904) and Regan (1907). To account for the reddish coloring in the black-spotted "montezuma" swordtail, the following comments are offered. In 1932, the writer collected 101 specimens of *Platypoecilus maculatus* in Mexico. One black-spotted individual was faintly but definitely *tinged with pink*. From this single male, a stock of black-spotted red-breasted fish was established. Since *Platypoecilus maculatus* and *Xiphophorus hellerii* are so closely related that they produce fertile intergeneric hybrids when mated,[3] perhaps *Xiphophorus hellerii*, too, has an occasional pink form in nature. Unfortunately there are no descriptions of live black-spotted swordtails that were taken by collectors in Mexico, but it is possible that some of them were tinged with red. If such an unusual fish reached the fish culturists' aquaria, keen fish breeders certainly would have tried to perpetuate and improve the strain.

The Genetics of the "Montezuma" Characters in the Common Swordtail, *Xiphophorus hellerii*

Kosswig (1933, 1935) has conclusively shown by substantial numbers that the "montezuma" characters, *red body color* and *large black spots*, are inherited together. The factor or factors for these two color patterns are linked with sex determiners, but the exact mechanism is still to be worked out. From many direct and reciprocal matings of "montezuma" (*Momo*) to common, wild or stippled (gray) swordtails (*momo*) Kosswig obtained equal numbers of "montezumas" (*Momo*) and stippled swordtails (*momo*) There were significantly more females in the "montezuma" group than in the stippled group ("montezuma," females 69%, males 31%; "stippled," females 32%, males 68%). The data are based upon 3266 individuals. Kosswig has shown also that, though the homozygous "montezuma" is rare in cultures, it apparently can be developed, for he obtained 683 "montezumas" to 246 stippled swordtails when he mated two heterozygous "montezumas." The homozygous "montezuma" (*MoMo*) may be completely sterile.

As early as 1918, aquarists noted that the "montezuma" variety matured very slowly and only a few developed into functional males. The aquarist Becker crossed a plain swordtail with a "montezuma" variety and obtained ten plain and ten "montezuma" type. After five years, the latter had no definite gonopodia, the sexual characteristic of the anal fins in viviparous cyprinodonts. One year later (1919), Becker reported that not one of the six-year-old "montezumas" had yet developed into "a decided male."

Another aquarist, Herr Rauhut (1934) reported that in a cross of "montezumas," at least half the offspring were plain colored swordtails. Herr Wohlert (1927) also reported obtaining about two hundred "montezumas" and about one hundred plain swordtails from a mating of two "montezumas."

[3] Friedman and Gordon (1934) have shown that *Xiphophorus montezumae*, *Xiphophorus hellerii*, *Platypoecilus maculatus*, *Platypoecilus xiphidium* and *Platypoecilus couchianus* have forty-eight somatic chromosomes; *Platypoecilus variatus* has fifty. These six species constitute the tribe Xiphophorini established by Hubbs (1924).

TABLE II

COLLECTION RECORDS FOR *Xiphophorus montezumae*

Collector	Year Collected	River	Place	Authorities	Pub.
Snyder	1899	Rio-Verde	Rascon, San Luis Potosi	Jordan and Snyder	1900
Meek	1902	Rio-Verde	Rascon, San Luis Potosi	Meek	1904
Gordon	1930	Rio Calaboza	Tantoyuca, Vera Cruz	Hubbs and Gordon	MS
Gordon	1932*	Rio Axtla	Axtla, San Luis Potosi	Gordon	1933

*Those collected in 1932 were brought back alive

TABLE III

GENETIC RECORDS OF MATING VARIETIES OF *Xiphophorus hellerii*

	Females			Males				Progeny			
								Montezuma		Non-montezuma	
Cross	Variety	Genotype	Pedigree	Variety	Genotype	Pedigree	Culture	Stippled	Non-stippled	Stippled	Non-stippled
1.	Montezuma Stippled	Momo StSt	183a	Montezuma Stippled	Momo Ststt	183b	183	5		2	
2.	Montezuma Stippled	Momo Stst	183–1	— (Gold)	momo stst	180–11	184	15	18	22	18
3.	— (Gold)	momo stst	180–9	Montezuma Stippled	Momo Ststt	183–11	188	31	14	18	12
4.	Montezuma Stippled	Momo Stst	183–2	— Stippled	momo Ststt	229–14	249	4	1	2	2
5.	Montezuma (Gold)	Momo stst	184–1	— Stippled	momo StSt	237–11	284	37		35	
6.	Montezuma (Gold)	Momo stst	184–2	— (Gold)	momo stst	180–16	309		35		30

He pointed out that the plain type developed, as a rule, into males, while the "montezumas" yielded "very few males."

The Interaction of Factors for Melanophores

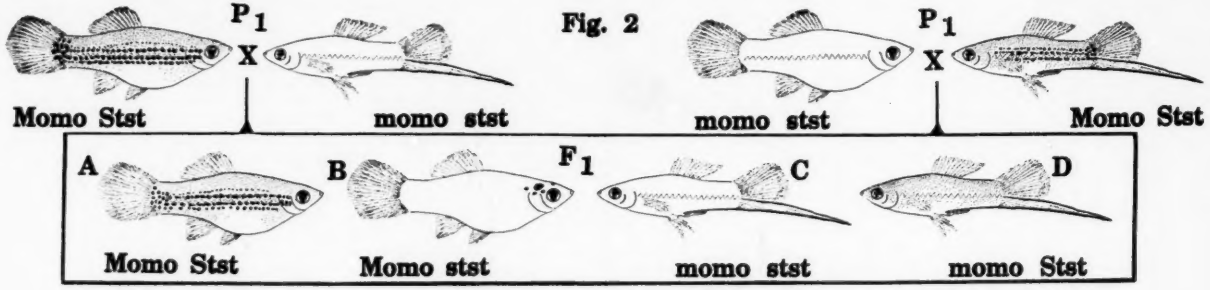
In Table III, two sets of data are treated together to show the genetic relationship of micro to macromelanophores. The "montezuma" is a complex of characters, consisting of an orange to red body color, plus a variable amount of black-spotting. The genetic symbol for this character was recorded by Kosswig as *Mo*. The recessive *mo* represents the phenotype of a swordtail with some other color pattern. The "montezuma" character apparently is more than a dual character—rather it is a triple color combination. The stippled pattern *St* (Gordon, 1937.1) characteristic of the common, wild or green swordtail must be added to the orange-red and the black-spotted characters. These three together produce the "montezuma" *Mo St* variety. That this is so will be brought out after a review of the details in Table III.

From the first, the "montezuma" variety of the swordtail showed its heterozygotic nature, *Momo*. From a purchased pair, five "montezumas" (*Momo*) and two normally colored or stippled swordtails appeared (*momo*) as indicated in Table III. By good fortune, two female "montezumas" and one male developed normally and were used in the following crosses. From a cross (number 2) of a female "montezuma" with a golden swordtail, four classes of swordtails appeared—one of which is new. The parent type of the female, the "montezuma" type, *Mo St*, of course appeared. The new type was a non-stippled "montezuma," *Mo st*. The appearance of the "montezuma" is changed radically by the loss of stipples. Most of the black-spotting disappears, but not all. In several specimens only one macromelanophore was left as an indicator of its "montezuma" black-spotted heritage. This black-spotting is restricted to the head region. Further details and significances of the change in the "montezuma" pattern complex will be considered at another point in this report. The third class that appeared in cross number 2 was the familiar, stippled, common wild or green swordtail. Its phenotypic constitution may be written as *mo St*. The fourth type repeated one of the parental male types—the double recessive, *mo st*, or golden swordtail.

In the reciprocal cross (number 3, Table III) a golden female swordtail was mated to a "montezuma" male. The results were the same as those obtained in cross number 2. (Kosswig also found that direct and reciprocal crosses yield similar results.) Again the "montezuma" non-stippled swordtails *Mo st* were only slightly spotted.

To see whether the full extent of the spotting characteristic of the *Mo St* or normal "montezuma" would be restored if the factor *St* were combined again with *Mo*, cross number 4 was made (Table III). In this cross, *Mo st* swordtails were mated to *mo St* with the result that *Mo St* swordtails were obtained fully as spotted as their grandparent "montezuma" swordtails had been. Cross member *S* shows this phenomenon, too.

When a non-stippled "montezuma" was crossed with a non-stippled (gold) swordtail (mating 6: *Mo st* by *mo st*), *Mo st* and *mo st* swordtail reappeared as had been expected, and the *Mo st* non-stippled "montezumas" did not have any more black spots than their parents. There seems, therefore, to be a definite relationship between the *St* and *Mo* insofar as these factors


P1
X
Momo Ststmomo ststmomo ststP1
X
Momo Ststmomo ststmomo ststmomo Ststmomo ststmomo ststmomo Ststmomo ststmomo ststmomo

affect black-spotting. *Mo* plus *St* makes a deeply spotted "montezuma" swordtail, whereas *Mo* with *st* produces an extremely weakly spotted "montezuma." [4]

COMPARATIVE GENETICS OF THE SWORDTAIL AND THE PLATYFISH

The reduction in the amount of spotting in the stippleless "montezuma," *Mo st*, has a direct parallel in the closely related species *Platypoecilus maculatus*. Gordon (1927, 1928) pointed out that the red, black-spotted, stippled *R Sp St* platyfish has many more black spots (macromelanophores) than the red, black-spotted, non-stippled *R Sp st* platyfish. When an *R Sp st* platyfish is mated with an *r sp St* individual, the *R Sp St* combination restores the former extensive black-spotting features. This parallel genetic behavior of the factor for stippling *St* (micromelanophores) in *Xiphophorus hellerii* and *Platypoecilus maculatus* is significant in a study of the common hereditary characters in closely related groups of organisms.

The swordtail and the platyfish have several genetic factors in common. *R* and *Sp* of the platyfish seem to be related to *Mo* of the swordtail. In the platyfish *R* (red body color) is closely linked to *Sp* (large black spots), and carried on the sex chromosomes. Fraser and Gordon (1929), Bellamy (1933) and Gordon (1937.1) have shown that crossing-over of about one per cent takes place. *Mo* of the swordtail may be a dual factor but "montezuma" has not yet been split into a red, non-spotted and a spotted, non-red fish. If *Mo* is a dual factor, black-spotting and red body color must be linked very closely. Another significant similarity between the genetics of the swordtail and of the platyfish is that *Mo*, like *R* and *Sp* is associated with sex. "Montezuma" (*Mo*) swordtails have a tendency to develop into females whereas those that are recessive for "montezuma" (*mo*) have a tendency to develop into males.

Micromelanophores that characterize the stippled platyfish may be referred to an autosomal factor *St*, and *st* represents the recessive factor that characterizes the gold platy. Apparently a comparable set of factors operates in the swordtail; that is to say, *St* is the stipple, wild type swordtail, and *st*, the gold swordtail. The *St* and *st* autosomal factors are not associated with the sex of the swordtail, for *Mo St* and *Mo st* "montezumas" tend to be females, whereas *mo St* and *mo st* "non-montezumas" tend to be males.

The platyfish has factors *C* and *T* for crescent and twin-spot respectively, which, with a common recessive, form an automsomally allelomorphic series (Gordon and Fraser, 1931). The swordtail has the allelomorphic factors *C* and *T* for comparable patterns; but these factors require the interaction of a third, independent factor *P* for pigment formation to effect a color pattern (Gordon, 1937.3). Thus the inheritance of the crescent and the twin-spot in the swordtail and in the platyfish indicates, in some measure, a common genetic bond.

Similarities in color patterns in swordtails and platyfishes are not confined just to *Xiphophorus hellerii* and *Platypoecilus maculatus*. Gordon (1933) has briefly indicated that the patterns black-spotting, crescent, twin-

[4] These weakly spotted "montezumas" are not to be confused with those that Kosswig figures (1933, fig. 5), which are stippled also. The weakness in spotting described by Kosswig concerns a degree of aggregation of macromelanophores rather than their numbers.

spot, and one-spot are found not only in the species indicated in this discussion, but also in *Platypoecilus variatus* and *Platypoecilus xiphidium*; *Xiphophorus montezumae* has the black-spotted and one-spot patterns and *Platypoecilus couchianus* has the black-spotted pattern. By intensive study of the inheritance of all the patterns in all the species of the *Xiphophorini*, it may be possible to trace the evolution of the genetic systems, as well as of the structural differences, in a closely related group of fishes.

Summary

Of the two aquarium fish known as "montezuma" swordtails, the reddish, black-spotted form is merely a color variety of *Xiphophorus hellerii*, being possibly a derivative of a spotted form of that species from the Río Coatzacoalcos in southern Mexico. The brownish-olive *montezumae* swordtail belongs to the true *Xiphophorus montezumae* of the Río Panuco system. The history of the identification and collections of these two forms is given in the text and in Tables I and II.

The "montezuma" variety of *Xiphophorus hellerii*, when crossed with the "golden" variety of swordtail, produces four types: 1. The "montezuma" type, *Mo St*; 2. The stippleless "montezuma" type, *Mo st*; 3. The "stipple" type, *mo St*; 4. The "golden" type, *mo st*. The dominant genetic factor *Mo* ("montezuma") controls the inheritance of *red body color* plus *large black spots* (macromelanophores). The dominant factor *St* (*stipples*) controls the inheritance of extremely small black spots (micromelanophores).

The combination *Mo St* produces a strongly spotted (macromelanophore) type. The combination *Mo st* produces an extremely weakly spotted (macromelanophore) type. The factor *St* for micromelanophores interacts with the factor *Mo* for macromelanophores. This parallels the situation found in the platyfish, *Platypoecilus maculatus*.

Mo may represent two factors in *Xiphophorus hellerii* one of which may control *black-spotting*, the other, *red body color*; just as *R* and *Sp* represent red and black-spotting in *Platypoecilus maculatus*. Thus there is considerable evidence to demonstrate a close, fundamental, genetic relationship between the swordtail and platyfish.

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On The Affinities Of The Chilean Fish, *Normanichthys crockeri* Clark

By J. R. NORMAN

ON September 5, 1931, the "William Scoresby" obtained a number of specimens with the small beam trawl, at a depth of 36 metres, at Station W.S. 742, off Mocha Island, Chile (38° 22′ S., 73° 41′ W.). Among these

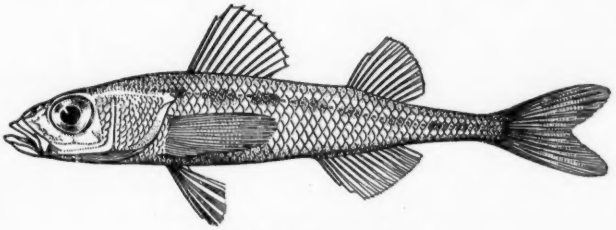

Fig. 1. *Normanichthys crockeri.*

were 42 examples, 55 to 110 mm. in total length, of what appeared to be an undescribed genus and species. One of these specimens was sent to Dr. Carl L. Hubbs, of the Museum of Zoology, University of Michigan, as I was then under the impression that this little fish belonged to a group in which he was particularly interested. To my surprise, Dr. Hubbs wrote to the effect that he had already received a few weeks previously a specimen of the same fish from Mr. H. Walton Clark, of the California Academy of

Sciences, San Francisco. This was one of nine individuals, the largest 74 mm. in total length, obtained by the Templeton Crocker Expedition of 1934–35, by means of a submerged light, in Valparaiso Bay, in February, 1935. Subsequently, Mr. Clark was kind enough to send me one of his specimens, together with the description he had prepared for publication, and I was thus able to confirm the identity of the fishes from the two localities. I take this opportunity of offering my sincere thanks to Mr. Clark for this courtesy, and also for naming the genus *Normanichthys* in my honor.[1] I am also indebted to the members of the "Discovery" Committee for permission to publish this note on the specimens collected by the "Discovery" Expedition.

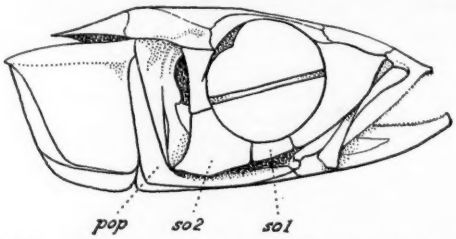

FIG. 2. *Normanichthys crockeri*: lateral view of skeleton of head. *so 1, so 2,* first and second suborbitals; *pop,* praeoperculum.
(Somewhat diagrammatic.)

Mr. Clark has little to say concerning the systematic position of this interesting fish, but quotes the comment of Dr. Hubbs regarding it, as follows:

> I take this fish to be a modified percoid, perhaps near the Haemulidae. The I, 5 rayed thoracic pelvics, spinous dorsal, ctenoid scales, marginal premaxillary, 4 + 1 branchiostegals, free gill-membranes, well-developed pseudobranchiae, and other superficial characters point to a position within the Percoidea. The characters of the maxillary slipping under the preorbital, and of toothless palate, suggest Haemulidae. The spineless anal, excentric scales (focus near posterior border), flexible dorsal spines, lack of spines and serrations on head, reduced number of principal caudal rays (only 12), attenuate body, etc., are very distinctive.
>
> The little fellow has some superficial aspects at least of a resemblance to a number of Chilean and Antarctic types, from which, however, the short dorsal fins and posteriorly inserted pelvic fins set it off. Unless something near this fish exists of which I am ignorant I would say a new family would be needed for its sole reception.

Investigation of a dried skeleton of a larger individual, and of a smaller specimen stained with alizarin and cleared in caustic potash solution and glycerine,[2] together with partial dissection of another small specimen, has enabled me to obtain a fairly clear conception of the osteology of *Normanichthys*. From the evidence obtained I conclude that this genus belongs properly to the division Cottiformes of the order Scleroparei, and may well be placed in the family Cottidae, of which it would appear to be a primitive member.

Examination of the skull shows that the second suborbital is produced backwards across the cheek, although it does not quite reach the praeoperculum (fig. 2). The opisthotic is small, and, although the sutures in this

[1] The description of this fish appeared in COPEIA, 1937: 90, fig.
[2] I am indebted to my colleague, Dr. E. Trewavas, for the preparation of this specimen.

region are very difficult to make out, I feel reasonably certain that this bone does not come into contact with the prootic. There seems to be no basisphenoid. The hyo-palatine bones are all present, and are normally developed, except the mesopterygoid, which is reduced. There are two pairs of upper pharyngeals, the third and fourth being united with each other and very closely approximated to the second. In the pectoral arch, the post-temporal is forked; there are four plate-like radials, all firmly united to one another, the foramina being very small; two of these are on the hypercoracoid, and two on the hypocoracoid (fig. 3). The praecaudal vertebrae have short parapophyses from the third, the anterior ones being nearly horizontal; the slender epipleurals are attached to the parapophyses; there are no ribs.

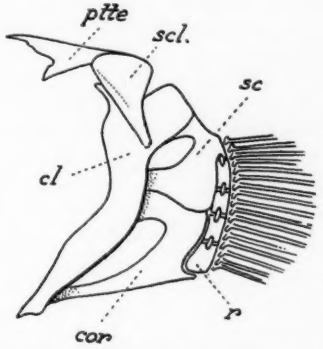

Fig. 3. *Normanichthys crockeri*: pectoral arch. *cl*, cleithrum; *cor*, hypocoracoid; *ptte*, post-temporal; *r*, radials; *sc*, hypercoracoid; *scl*, supra-cleithrum.
(Somewhat diagrammatic—the post-clavicles have been omitted.)

All the above-mentioned characters place this fish in the division Cottiformes as defined by Regan (1913),[3] and it may well be included in the family Cottidae of his classification. Further confirmation of this view is provided by a study of the otolith, for which I have to thank Mr. G. Allan Frost. He writes that the sagitta of *Normanichthys* "is practically identical in all features with that of *Cottus gobio*."

The complete and uniform scaling of the body distinguishes *Normanichthys* from any other genus of Cottidae known to me, but its nearest relatives would appear to be *Jordania*, *Paricelinus*, and *Alcidea*, none of which is represented in the collection of the British Museum (Natural History).[4] In his classification of fishes (1923),[5] Jordan has subdivided the Cottidae as formerly understood into several families, of which the Jordaniidae is instituted for the genera mentioned above. The characters of this family are given as: "Ventral rays I, 5; head narrow; scales present, often reduced to a few

[3] *Ann. Mag. Nat. Hist.*, (8) 11: 173, 179.
[4] For descriptions of these genera, see Jordan and Evermann, *Bull. U. S. Nat. Mus.*, 47, 1898: 1884–1888.
[5] *Stanford Univ. Publ., Biol. Sci.*, 3, No. 2: 211.

radiating spinules." [6] I have compared the osteology of *Normanichthys* with that of *Scorpaenichthys*, another Cottid genus with fully developed pelvic fins, and I am unable to discover any differences of fundamental importance.

Normanichthys is probably the only member of the family Cottidae found south of the equator, and, as has been pointed out above, its relationships appear to be with certain primitive Cottid genera occurring on the Pacific coast of the United States. I have previously shown[7] that *Sclerocottus schraderi* Fischer was incorrectly recorded from South Georgia, and is a synonym of the well known *Gymnocanthus tricuspis* (Reinhardt), from arctic and subarctic seas. *Bunocottus apus* Kner[8] is known only from the unique holotype, said to be from the Burdwood Bank near Cape Horn.[9] As the specific name implies, this fish is described as being without pelvic fins, but Kner's figure shows these fins present in the normal position and apparently composed of four rays. Assuming that pelvic fins are developed, the fish depicted shows a very marked resemblance to *Dasycottus setiger* Bean, from the North Pacific,[10] and it seems possible that the type of *Bunocottus apus* may have come from that region rather than from the Southern Hemisphere. It may be noted that the paper published by Kner deals with a mixed collection of fishes in the museum of Messrs. Godeffroy and Son of Hamburg, a collection which included specimens from various parts of the world. The type locality of *Cottus tentaculatus* Kner (*op. cit.*: 314) given as Singapore, is probably also incorrect, and this fish is described as being most nearly related to a species from the North Pacific.

I am greatly indebted to Dr. C. Tate Regan, F.R.S., for assistance in determining the systematic position of *Normanichthys*. The figures accompanying this paper have been drawn for me by Mr. A. Fraser-Brunner.

Department of Zoology, British Museum (Natural History), London, England.

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[6] As suggested by Regan (1913, *op. cit.*: 181), the extinct genera *Eocottus* and *Lepidocottus*, placed by Jordan in this family, may belong to the Gobioidea.

[7] Copeia, 1935: 141.

[8] *SitzBer. Akad. Wiss. Wien*, 58, 1868: 316, pl. III, fig. 9.

[9] Unfortunately, it has been impossible to trace the type of *Bunocottus apus*. Dr. V. Pietschmann informs me that it is not in the museum at Vienna, and Miss Erna Mohr has been unable to find it in the museum at Hamburg.

[10] I have to thank the authorities of the United States National Museum for their courtesy in sending me three specimens of this species as an exchange with the British Museum (Natural History).

Peter Artedi—Systematist and Ichthyologist

By Daniel Merriman

THE name of Peter Artedi is familiar to most zoologists—particularly so to those engaged in the study of fishes. It is associated in their minds with the man who has come to be called the "Father of Ichthyology." But beyond a brief outline of Artedi's all too short life, which can be found in several of the recent histories of biology,[1] there is little information that is readily accessible to those who are interested in knowing more. Nor should ichthyologists alone be thus interested, for although Artedi's greatest fame now lies in his work on fishes, he deserves even more credit for his system of classification which applies not only to fishes but to all animals.

PETRI ARTEDI

SUECI, MEDICI

ICHTHYOLOGIA

SIVE

OPERA OMNIA

de

PISCIBUS

SCILICET:

BIBLIOTHECA ICHTHYOLOGICA.
PHILOSOPHIA ICHTHYOLOGICA.
GENERA PISCIUM.
SYNONYMIA SPECIERUM.
DESCRIPTIONES SPECIERUM.

OMNIA IN HOC GENERE PERFECTIORA;
QUAM ANTEA ULLA.

POSTHUMA

Vindicavit, Recognovit, Coaptavit & Edidit

CAROLUS LINNÆUS,

Med. Doct. & Ac. Imper. N. C.

LUGDUNI BATAVORUM,
Apud CONRADUM WISHOFF, 1738

Fig. 1. Title page of Artedi's *Ichthyologia*.

There are, however, two books, which although not always available, afford ample material on the life and scientific accomplishments of Peter Artedi. The first is Artedi's *Ichthyologia*, published in 1738 at Leyden, the title page of which is shown in Fig. 1. This work appeared three years after

[1] "The History of Biology—A Survey." Nordenskiöld, Erik. (Translated from the Swedish by Leonard Bucknall Eyre.) Alfred A. Knopf, Inc., N.Y., 1928: 209–210.

Artedi's death, and was printed through the efforts of Linnaeus, who had obtained all of Artedi's manuscripts and was determined to give to posterity the labors of his friend. Aside from the value of this book as the best example of Artedi's work, it is particularly interesting because its first eleven pages compose an introduction written by Linnaeus dealing with Artedi's life. However, a more complete history of Peter Artedi, as well as a full discussion of his methods and system of classification, appeared in 1905 in the form of a 44-page pamphlet under the title of "Peter Artedi—A Bicentenary Memoir written on behalf of the Swedish Royal Academy of Science," by Einar Lönnberg, translated by W. E. Harlock, and published at Upsala and Stockholm, Berlin, London, and Paris.

The present paper on Peter Artedi is not merely a summary of the main points in these two references. It also attempts to provide various new interpretations of the available material.

Artedi's Life

Peter Artedi was born in 1705, in Anundsjö, Sweden, where the parish register gives the date of his birth as February 27 (O.S.) or March 10 (N.S.). His father, Olaus Arctædius, and his paternal grandfather were both parsons, while his maternal grandfather was a teacher of philosophy and a Court Chaplain at Stockholm. Peter was the second of five children, two of whom died, leaving the future scientist, his elder sister, Anna, and the last born child, Elizabeth. According to the custom of the time, he was consecrated to the church early in his life.

In 1716 the Arctædius family moved to Nordmaling so that the father, Olaus, might take charge of that parish in place of his own father, who was of such an advanced age that he had become blind and feeble so he could no longer properly discharge his duties. This move meant that Peter Artedi now lived on the Gulf of Bothnia, a fact which undoubtedly pleased him and had a great effect on his future life, for he had already expressed a desire to know about fishes as well as to understand the healing properties of plants. That autumn he went to school at Hernösand, where he soon acquired the reputation of being an excellent scholar. He read with particular interest the works of the early alchemists and spent much of his time collecting and studying animals and plants.

In 1724, having graduated from school with honors, he went to the University at Upsala, where his name still exists in the university register.[2] It was his father's express wish that he study theology and philosophy, but the interest aroused in him by his earlier readings of the alchemists was too great, and so, completely against his family's desires, he took up chemistry. He is said to have been the only student in this field at Upsala, and he soon entered the School of Medicine where he was given a royal stipend. He devoted himself to the natural sciences, and in spite of the fact that he had practically no guidance—for there was no one at that time at the University who was actively engaged in teaching the subjects in which he was interested —he soon acquired a reputation in his field.

In 1728 Linnaeus arrived at Upsala and, upon inquiring who at the

[2] Lönnberg notes that Artedi apparently did not sign the register himslf, for there is a slight misspelling in his surname. His own signature, however, appears in another register in which the students wrote their names and the amounts they deposited to the library fund.

University was engaged in the study of natural science, was at once told that Peter Artedi was the man he should see. Linnaeus, in speaking of his first meeting with Artedi, describes him as being tall and thin, with long black hair, and resembling John Ray. He further mentions that he was considerate, cool of judgment, and a careful observer. Linnaeus recounts that Artedi was the slower of the two, but the more accurate, and he also speaks of him as a fine linguist and a delightful conversationalist. A spirit of friendly rivalry grew up between them during the seven years they were together at Upsala, and they vied with one another in every field of the natural sciences, although Artedi devoted himself more and more to fishes and Linnaeus to plants.

In 1734, Artedi expressed regret at the fact that he had lived for ten years in one place; he wanted to go elsewhere to examine different specimens, but he had no money for travel. However, when neither he nor Linnaeus had their scholarships renewed at Upsala, both of them left. Artedi went to his relatives at Umeå and was given sufficient money to go to London. But first he returned to Upsala, and there on July 17 he successfully passed the examination in theology at that time required of all students who were intending to travel abroad for future study.

There is little known concerning his life in England, but in the summer of 1735 he met Linnaeus again, quite by accident, in Leyden. Linnaeus tells of their joy at seeing each other again, and he mentions that Artedi had profited by his stay in England and particularly by his contact with Sir Hans Sloane, a famous naturalist of the time who later became Physician in Ordinary to King George I and also President of the Royal Society. Artedi was at this time entertaining the possibility of getting his doctor's degree in Holland, but almost all his money was gone.

There was, however, in Amsterdam a rich man named Albertus Seba, who had amassed an extraordinary collection of zoological specimens. Two volumes on the quadrupeds and serpents in his collection had already appeared, and he now desired to get someone to undertake a volume on the fishes. He had asked Linnaeus to do this for him, and the latter declined. But when Linnaeus found Artedi short of money he promptly introduced him to Seba, who immediately engaged him to work up the collection of fishes.

Linnaeus then returned to Leyden to resume his studies, and Artedi remained in Amsterdam to work on Seba's fishes. Several months later, when Linnaeus had completed his *Fundamenta Botanica,* he returned to Amsterdam to obtain Artedi's advice on his new work. This was to be the last meeting of the two, and in view of what ensued, Linnaeus' account of their conversation is especially interesting. For far from securing the advice he had come for, his whole visit was monopolized by Artedi, who, having just completed his *Philosophia Ichthyologiæ,* insisted on reading it aloud from beginning to end. Moreover he showed manuscripts which Linnaeus had never seen in spite of their close friendship. Thus he kept Linnaeus so late, that the latter became quite tired, and if we may judge from his own account, annoyed.

Linnaeus returned to Leyden, and several days later on September 27, 1735, Artedi went to dine with Seba and a number of other guests. Accord-

ing to Linnaeus, he stayed late and spent a pleasant evening in conversation. Then, leaving Seba's house, he started home through the dark streets unfamiliar to him, and although no one saw him, it is generally believed that he made a misstep and that he fell into a canal and was drowned. His body was found the next day and was removed to the City Hospital.

Linnaeus did not hear of the tragedy that had befallen his friend until three days later. Arriving at Amsterdam he found that the body had been claimed by Artedi's former landlord and that Seba had provided some money for the burial. Linnaeus himself describes his grief at seeing the body, and he was at once determined to fulfill the vow he and Artedi had taken years before at Upsala, that the survivor would make every effort to publish the manuscripts left by the other.

However, when Linnaeus approached Artedi's former landlord with a view to acquiring his friend's manuscripts, he met with considerable difficulty. It appeared that Artedi had payed no rent at his lodgings, for Seba had given him no compensation for the work he had done. The landlord therefore laid claim to all Artedi's goods. Linnaeus in the meanwhile wrote to Artedi's relatives asking permission to claim and publish all his friend's manuscripts. To this he soon received a favorable reply. The landlord then rendered a bill for what was owed him, but since Linnaeus had only enough money to pay half the amount, the landlord proposed having a public auction of all Artedi's goods. In desperation Linnaeus went to see Seba and pointed out that since he had not payed Artedi anything for his work, the least he could do was put up enough money to cover the other half of the landlord's bill so that Linnaeus might obtain the desired manuscripts and give his friend's work to posterity. But Seba wanted the manuscripts for himself and would offer Linnaeus no help. Instead he urged the auction, with the idea, so Linnaeus says, of getting the things for himself, perhaps at less expense, and knowing full well that no one would bid far against him. At that point, Linnaeus persuaded George Clifford, an Englishman then living in Holland whom he had just met, and who later supported much of Linnaeus' own work, to pay the needed amount. Thus Artedi's manuscripts finally came into his friend's hands. The eventual result of his acquisition was the publication by Linnaeus in 1738 of Artedi's *Ichthyologia*.

Artedi as a Systematist and Ichthyologist

It is no easy task to arrive at a sound estimate of Artedi's scientific attainments. That he was a first-class ichthyologist who studied and described his specimens with far more care and accuracy than any of his predecessors, there can be no doubt. Moreover, his system of classification for the fishes was far superior to anything that had appeared before. But how much of his system for classifying fishes was original, and to what extent was he responsible for the Linnaean classification that followed shortly?

To have any clear understanding of these issues it is necessary to look at Artedi's predecessors and see what links they supplied in the chain that led to the systems of classification of comparatively modern times. As far back as the Greek civilization, a system of classification almost 2,000 years ahead of its time was produced by Theophrastus,[3] who grouped plants in four main divisions which were in turn split into smaller groups even down to the genera

CLAVIS ORDINUM.

PISCES
- cauda perpendiculariter pinnarum radiis
  - ossei, branchiis
    - officulatis, pinnis
      - inermibus — MALACOPTERYGII I
      - pungentibus — ACANTHOPTERYGII II
    - ossibus destitutis — BRANCHIOSTEGI III
  - Cartilagineis — CHONDROPTERYGII IV
- cauda horizontali — PLAGIURI V

Malacopterygii subdividi possunt: in

α. Pinna dorsi unica, in medio fere dorsi; *genus* 1 ad 6

β. Pinna unica in medio fere dorsi & unica postica dorsi adiposa — 7 — 9

γ. Pinna unica in extremo dorsi — 10 — 11

δ. Pinna unica pluribusve per totum dorsum extensis — 12 — 17

ε. Pinna dorsi unica longa, vix a cauda distincta 18 — 19

ζ. Pinna exigua unica in extremo dorsi vel nulla 20 — 21

Acanthopterygii sunt vel

α. Capite glabro — 22 — 29

β. Capite aspero — 30 — 31

ORDO I.

MALACOPTERYGII.

1. SYNGNATHUS.

Opercula Bronchiorum ex unica tenui lamella ossea utrinque constantia.

Membrana Branchiostega.....

Caput oblongum, cathetoplateum: Maxillæ à lateribus clausæ & OS in extremitate rostri tantummodo apertum.

Corpus longum & admodum gracile, ambitu plerumque angulato, interdum subrotundo: jam tetrapterygium, jam monopterygium.

Species.

1. SYNGNATHUS *corpore quadrangulo, pinna caudæ carens, Art. Syn.* 1.
Hippocampus Auctorum.

2. SYNGNATHUS *teres; Pinnis pectoralibus caudæque carens. Art. Syn.* 2. *spec.* 1.
Acus lumbriciformis, seu Ophidion lumbriciforme. Ray Syn. p. 47.

3. SYNGNATHUS *corpore medio heptagono, cauda pinnata. Art. Syn.* 2. *spec.* 2.
Acus Aristotelis species altera, major. Will. p. 159.
Corpus ab ano ad finem pinnæ dorsalis hexagonum. Cauda longior quam ipsum corpus, quadrata.

4. SYNGNATHUS *Corpore medio hexagono, cauda pinnata. Art syn.* 1. *spec.* 3.
Acus Aristotelis, seu Acus secunda species. Willugh. p. 158. *Ray p.* 46.
Laminæ crustaceæ à Capite ad anum 18. ab ano ad caudam 35. vel ut scribit Will. ultra anum in 34 vel 35.

Fig. 2. Two pages from the *Ichthyologia,* illustrating the Artedian method of classifying the fishes.

and species. This work, however, had little influence at the time, and nothing comparable to it is found until after the Renaissance, when a long succession of botanists dealt with taxonomical problems. One of the first of these was Valerius Cordus[3] (1515–1544), who in spite of his short life was far ahead of his day, not only in his conception of species but also in his whole system of classification. He was followed by such men as Cesalpino, Bauhin, and Jung, all of whom made definite advances and cleared the way for those who were to come. It was John Ray, however, whose systematic work appeared at the end of the 17th century, who first made concrete the idea of the species. In his mind, plants that gave rise to new plants similar to themselves through their own seeds belonged to the same species. He did not regard different colored flowers of the same plants as separate species, since color variations are not reproduced through seed but only through cuttings.[4] Ray of course extended his work outside of botany. With his friend and collaborator, Francis Willughby, he established the species concept in zoology, as well as botany, far more firmly than it had even been before. Furthermore, Joseph Pitton de Tournefort, a French botanist and contemporary of Ray, worked out a system of classification for the groups above the genera. He divided plants into a series of classes, and these in turn he split up into various sections which were described in a few brief words, but were not given names. His work added nothing particularly new to what had appeared before, but it is of some importance in this discussion since it apparently received considerable attention from Artedi.

It was with this background, then, that Artedi, approximately a quarter of a century after Ray and Tournefort, began his work. It is obvious that he was familiar with the work of his predecessors in botany, for his early writing was in that field. A manuscript of his dated February 24, 1729, and bearing the title, "A Short List of the Trees, Bushes and Plants that are Indigenous to the Glebe-Lands in Nordmaling and the Villages lying in its Immediate Vicinity," is still preserved in the Upsala University Library.[5] There is no doubt that Tournefort's system formed the model on which he built in this paper; but at the same time he made various changes and improvements which Lönnberg states, show that "Artedi gives clear evidence of having followed up independent lines of thought and of being endowed with considerable talent as a systematiser."

It is, however, in his later work on fishes that Artedi made his greatest improvements on the system of classification. When it is considered that this was the first thorough appplication of such a system in any branch of zoology, its importance must be conceded. It is true that Ray, through Willughby, had introduced the species concept into zoology, but his classification of the major groups left much to be desired. Artedi incorporated the ideas of Ray and Tournefort in dealing with the fishes, and brought some measure of order out of the chaos that had existed before. He began as Tournefort had, with the genus, which he believed to be a collection of species which agreed with each other in the general relations of parts but which differed in these

[3] For accounts of Theophrastus and Cordus see *Landmarks of Botanical History* by Edward Lee Greene, Smithsonian Misc. Coll., 54, 1909.

[4] Nordenskiöld, *loc. cit.*: 200.

[5] This paper was published in 1905 in connection with the commemoration of the 200th anniversary of Artedi's birth (Lönnberg).

respects from the members of other genera. For generic characters he used such features as the number of branchiostegals, the location of the teeth, the fin structure, the type of stomach and pyloric caeca, the intestine, the bladder, etc., and to every genus he gave a separate name. For example, whereas before some 14 names had been used to designate the members of his herring genus, he combined them all under the name *Clupea*. Further than this, he clarified the general zoological nomenclature by substituting new names for all those then applying to several kinds of animals. He was meticulous in his choice of names, choosing only those of Latin and Greek origin and rejecting all those used also to designate different objects.

Having thus established the genera of fishes, he proceeded to group them in maniples—the families of a later date—and the maniples were, in turn, arranged in natural orders which collectively constituted a class. The class he used to designate the whole group of fishes.

Turning now to the divisions below the genera, we find the one weakness in the Artedian system, for the species distinctions were based only on differences within the genus in some individual part of the body. And where he had given each of the genera a separate single name, he attempted for the species a brief description, thus retaining the polynomial scheme of nomenclature. His species characterizations, however, were remarkably accurate, and Günther in 1880 spoke of them as ". . . descriptions which even now are models of exactitude and method."

Moreover, Artedi did not think of his whole system of classification as applicable only to fishes. He more than once makes the point that the same type of revision should be applied to all of zoology. In regard to generic distinctions, he says that natural characters constitute ". . . *primum et præcipuum Fundamentum non solum Ichthyologiæ sed totius reliquæ Historiæ naturalis.*"

It was by such a method that some system of orderly classification and grouping was evolved. There can be little doubt that Artedi's system had much to do with the Linnaean classification that was to follow. Günther in his *Introduction to the Study of Fishes* (p. 10) says of Artedi's work, ". . . in fact he establishes the method and principles which have subsequently guided every systematic ichthyologist."

Thus it becomes evident that Peter Artedi not only synthesized and improved the works of his predecessors, but that he was the first to produce a system of classification approaching modern standards in any branch of zoology. He realized the universal applicability of his system, and he saw that something of the sort must be worked out for the whole of zoology to obtain any semblance of order. He may well be said to have supplied the last link in the chain of events which led to the Linnaean system of classification, for it remained only for Linnaeus to revert to Ray's species concept and to take the final step to a binomial system of nomenclature.

The author wishes to thank Mr. Henry Rowell of Yale University for assistance in the translation of the introduction of Artedi's *Ichthyologia*.

Osborn Zoological Laboratory, Yale University, New Haven, Connecticut.

The Breeding Habits of the Black-sided Darter, *Hadropterus maculatus* Girard

By Walter P. Petravicz

CONCERNING the breeding habits of "the fine gentleman of the family," *Hadropterus maculatus* Girard, I have discovered no detailed description in ichthyological literature. A brief, casual observation was recorded by T. L. Hankinson (1932), namely, that the male and female while applying their bodies closely, undulate them vigorously and deposit the eggs in loose gravel.

Black-sided darters were netted in the Belle Branch of the River Rouge in southern Michigan. During the late spring and early summer months, specimens were captured in depressions with a bottom of sand and gravel. Catches were first transported to a 48 gallon aquarium with water temperatures of 14° C. to 19° C. On the following day, they were transferred to 12 and 6 gallon balanced aquaria with water temperatures of 19° C. to 23° C. and containing fresh-water plants. The bottom was formed of fine sand with gravel areas in some tanks. The aquaria were situated either directly in front of a window, or a few feet to either side.

Black-sided darters are quite hardy and are easily maintained in an aquarium. They can survive at least 40 days without being fed, although they become emaciated from lack of nourishment. Their diet, however, is easily supplied, for they eagerly eat white worms (*Enchytraeus*), crushed crayfish, may-fly and damsel-fly nymphs, cubes of fresh beef and pork, and even attempt to swallow snails and caddis worms. That may-fly nymphs are included as food for black-sided darters agrees with the observation of J. R. Greeley (1927) and C. L. Turner (1921). Forbes and Richardson (1909) record that miscellaneous aquatic insects serve as food for this species. In the aquaria, adult black-sided darters made many unsuccessful attempts to seize a species of large dragon-fly nymph, and actually did feed upon some of the smaller species. They refused to eat leeches, unlike *Percina caprodes* whose food habits are noted by A. S. Pearse (1918), and they do not devour the eggs immediately after spawning as do the log perch described by J. E. Reighard (1913).

The habits of the black-sided darters were studied both in the aquarium and stream from August, 1936, to May, 1937, except during November, December, and January, when observations were made only in the aquaria.

Sexual Dimorphism

The sexes were found to attain equal lengths, varying from 7.0 to 8.3 cm. This conforms with the published descriptions, which do not consider the possibility of sexual difference in length. Of course, during the breeding season, ripe females develop the characteristic abdominal distension, whereas the males retain their slender forms.

The sexual dimorphism of the ventral fins of this species is slightly similar to that of its relative *Microperca punctulata* Putnam, described by

J. J. Petravicz (1936). The anterior flap of the fin which contains the spine is sturdier and bulkier in the male (Fig. 1). The distal end and the exterior border of this spine and the adjacent ray are very stout and crenate. Most likely this structure serves to facilitate the maintenance of the clasping position. The spread of the male's fin is also broader than that of the female. This sexual dimorphism of the ventral fins is permanent throughout the year. Except for the more delicate rays and spines in the fins of the female, no other sexual dimorphism was recognized in the remaining fins.

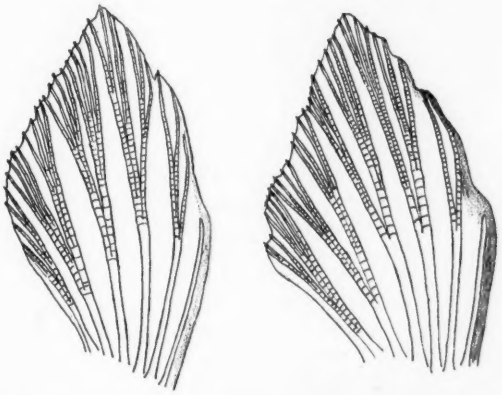

FIG. 1. Showing pelvic fin of a female (left), and that of a male (right). Ventral view.

PIGMENTATION

The female retains the same color pattern throughout the year, except that the slaty shades become notably intensified during the breeding season and somewhat browner than at other times. The blotches of the lateral band seem to become more continuous. In the male the hues are intensely dark during the nuptial season, as Forbes and Richardson (1909) have recorded. Furthermore, the male undergoes striking changes both in color and pattern just prior to, and during the *individual breeding acts*. The dark brown iris transforms into brilliant gold. The thin black line on the cheek running ventrally from the dorsal part of the eye becomes coal-black and slightly wider. The partially green opercle and dull green cheek become a dusky emerald green entirely. Even more striking is the modification of the body color and pattern. Almost all of the checkerboard dorsal design, the lateral brown-blotched band, and the cream-colored ventral region change into green or yellow gold, upon which appear 6 or 7 wide, slate-silver, vertical bars. The ventral and anal fins usually become a dark gray; and the caudal, ventral, and especially the dorsal fins bear a darker shade of black. As Forbes and Richardson (1909) describe, the anal fin becomes dusky during the breeding activities. The male assumes this nuptial coloration in the presence of females, as noted by Jordan and Copeland (1876). The change has been observed even in the fall, after the close of the breeding season.

The spawning female exceptionally develops a brilliance somewhat conformable with that of the male. Such coloration, when it does occur, together with a belligerent attitude, may serve in frightening away pursuing males.

Spawning Activities

Initial spawning was observed in the aquarium on March 19, and in the natural habitat on May 3, when the water temperature was 16.5° C. and the pH content about 8.1. In the natural habitat the spawning occurred over sand and gravel where the water was about a foot deep and the current moderate.

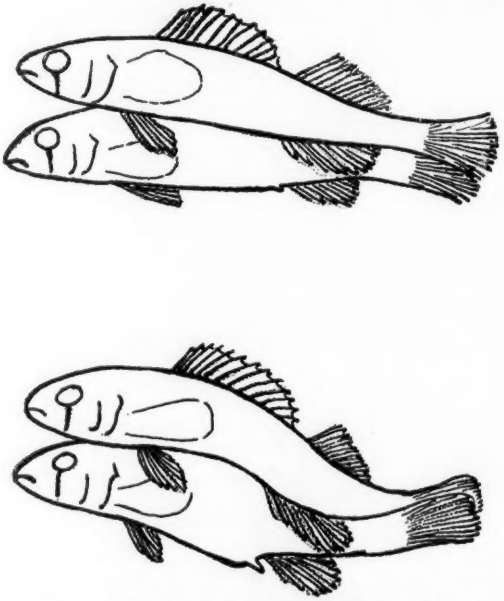

Fig. 2. The spawning act, showing (above) the clasping position, and (below) the spawning act. Natural size.

The spawning activities are alike, in nature and in aquaria. The female usually initiates the spawning by nervously and laboriously swimming to a desirable depression of sand or gravel, where she is pursued by males. Immediately after the female comes to rest, one male assumes the clasping position (Fig. 2 above). Simultaneously the pair vibrate their bodies for several seconds, meanwhile forcibly pressing the genital apertures of their quivering bodies into the gravelly or sandy depressions where the eggs are deposited. When spawning on sand, the fish throw up a cloud of bottom material, and thus form a shallow depression. Their motions are not strong enough to disturb gravel.

When the pair have ceased vibrating their bodies, the male abandons the clasping position, and both fish lie exhausted on the bottom a few inches

from the spawning location. Their fatigue is indicated by the laborious gasping and the relaxed dorsal and caudal fins.

Five minutes or even a half hour may elapse before the spawning act is repeated. The female, spawning periodically from early morning until late afternoon, is usually spent within about 2½ days.

Fig. 2 partially portrays the appearance and relative positions of the fins during the clasping and spawning acts. To assume the clasping position, the male, having his fins extended, grasps the female dorsally with his ventral fins slightly anterior to her relaxed dorsal fin. His limp caudal fin rests alongside of and to the right or left of the female's relaxed caudal fin. During the vibratory motion, the male and female maintain their anal fins in a fan-like position and vigorously propel their pectoral, ventral and caudal fins. Unlike the female, the male also spreads his dorsal fin.

Rival Males

Although the eggs of a female are fertilized by various males, only one male, not always the brightest in color, nor the largest, accompanies the female for each spawning act. The most aggressive male drives away rival ones contesting for the clasping position. Only once have I seen a defeated rival dart back to the spawning pair to press alongside the female and join in the vibratory motion.

Incubation

The adhesive, demersal, spherical eggs, 2 mm. in diameter, are deposited, as noted above, in fine gravel or sand. Never are they laid on leaves of plants, on stones, or twigs, as recorded for the related species *Microperca punctulata* Putnam (J. J. Petravicz, 1936).

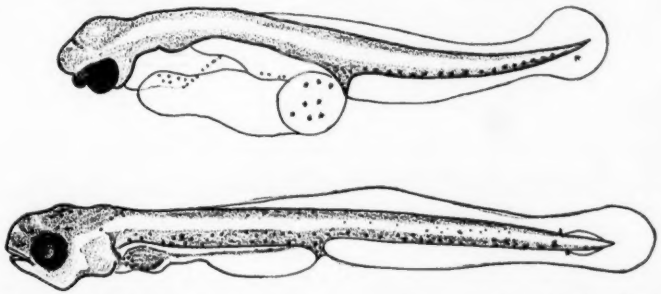

Fig. 3. Newly hatched larva (above), and post-larva 21 days after hatching.

Some of the eggs were collected by passing a sieve through the fine sand in which they were laid. They were placed in running water. Within 57 hours the heart began to beat, pulsating 80 times a minute. The blood was seen flowing within 70 hours, and the minimum incubation period was 142 hours. The newly-hatched fish measures 5.75 mm. from the tip of the mouth to the extremity of the caudal fin. The black-sided darter after hatching lives in the surface strata of the water, and within three weeks may drop to the bottom strata. The melanophoric design appearing in the newly hatched and in three weeks old larvae is portrayed in Figure 3.

Melanophores are not visible on the head of this species when it hatches, but within three weeks they partially indicate the adult coloration, consisting of four lines radiating from the eye, three of which are posterior and one anterior to it. Dorsally, the body of the newly-hatched fish discloses no pigmentation. Within three weeks some configuration appears, but it is difficult to recognize a resemblance to the permanent checker-board design. Ventrally, the melanophores are at first accumulated in the yolk sac, anal, and postanal regions, but within three weeks they become visible upon the entire ventral portion of the body. Except for one melanophore located on the caudal fin close to the body of the newly-hatched fish, none were found in any of the fins for at least three weeks. All the fins of the adult black-sided darter contain melanophores.

I am indebted to Dr. Carl L. Hubbs for his stimulating and constructive criticism concerning the material of this article.

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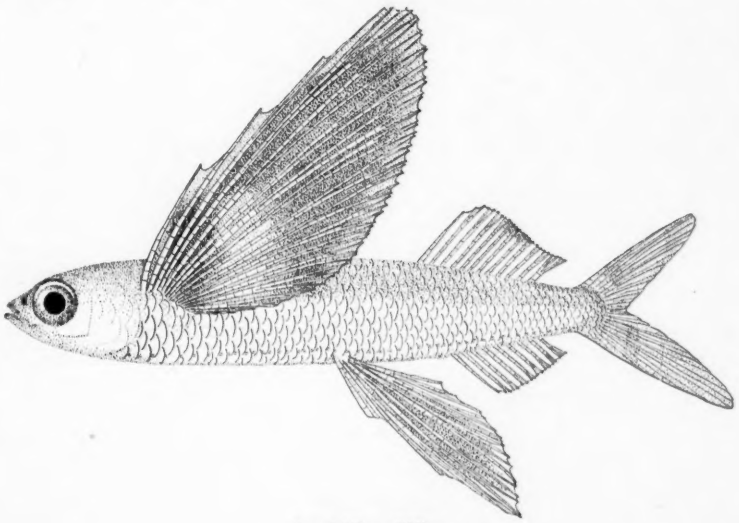
Department of Biology, University of Detroit, Detroit, Michigan.

Ichthyological Notes

A FISH NEW TO MASSACHUSETTS.—On September 1, 1937, I found at the water's edge on Harding's Beach (Nantucket Sound), in the town of Chatham, on Cape Cod, a flying fish, dead but perfectly fresh, which I preserved. It was a lovely object, of a deep but most brilliant blue—Gulf Stream Blue—above, and snowy white below, slim and with graceful proportions.

When I presented this specimen to the American Museum of Natural History, it was identified by Mr. J. T. Nichols as *Cypselurus gibbifrons*, or, if Mr. Breder's splitting of the genus be followed, *Prognichthys gibbifrons*. As this is, I understand, the largest individual—standard length, 97 mm. (to base of tail); total length, 115 mm.—yet secured of this rare species (new to the American Museum's collection), and, furthermore, as it is (*fide* Mr. Wm. C. Schroeder, of Harvard's Museum of Comparative Zoölogy) apparently the first to be found north or east of the waters off Newport, Rhode Island, where but one has been taken, it seems worth while to put the occurrence on record.

Mr. C. M. Breder, Jr., of the New York Aquarium, found this specimen sufficiently interesting to have a drawing made of it for his forthcoming work on the flying fishes, and this drawing he has kindly offered for use at this time.



Prognichthys gibbifrons
97 mm. s. l.
Collected by C. H. Rogers. Drawn by Ralph Graeter.

It is perhaps appropriate that my ornithological self, now specializing on his Museum's behalf in the birds called swifts, should write his first ichthyological note on a "swift-tailed" (*Cypselurus*) fish.—CHARLES H. ROGERS, *Princeton Museum of Zoölogy, Princeton, New Jersey.*

A RECORD OF THE POMFRET AND BARRACUDA FROM ALASKA.—One specimen each of barracuda (*Sphyraena argentea*) and pomfret (*Brama raii*) was taken in a salmon trap at Cape Uyak (57° 38′ N. Lat. 145° 21′ W. Long.) on the west coast of Kodiak Island during September, 1937. These fish were turned over to the University of Washington School of Fisheries by Mr. William Calvert of the Alaska Southern Packing Co., Inc. The barracuda was one of a school seen by fishermen in the vicinity of the trap

on September 6. The pomfret was taken on September 10. To our knowledge this is the farthest north that barracuda have been recorded and is the most northerly record of pomfret in the Pacific Ocean.

The following measurements are noted:

Sphyraena argentea. Head 3 3/4 in body. Maxillary 3 in head. Eye 9 1/2 in head, 4 in snout. D.–V, 10, 10; A–I, 10. Scales above lateral line 274, in lateral line 166. Total length 80 cm., body length 69 cm. Sex, female.

Brama raii. Head 4 in body; depth 2 1/3. D.–III, 30, A.–III, 27. Scales above lateral line about 89, in lateral line about 84. Eye 4 in head, as long as snout. Pectoral fins 2 2/3 in body. Total length 44 cm., body length 37 cm.

At the time the above specimens were taken, schools of mackerel about 8 inches in length were also seen around the trap by the fishermen. Since no specimens were obtained, their identity is doubtful but they were probably *Pneumatophorus diego* since this species has been reported from Prince William Sound (Rounsefell and Dahlgren, COPEIA (1), 1934: 42).

Captain J. E. Shields of the cod fishing schooner *Sophie Christenson* reports the capture of considerable numbers of pomfret with small trolling spoons between 100 and 600 miles to the eastward of Unimak Pass. On the return trip from Bering Sea in August several years ago, 70 specimens were taken in one day. A drawing by Mason Gray, a student in the University of Washington Fisheries School, who was aboard when the same species was taken on the return trip in 1937, leaves no doubt that these fish were *Brama raii.* The color is reported as brilliant silvery when alive, turning to dull brown or almost black after death.—RICHARD VAN CLEVE and W. F. THOMPSON, *International Fisheries Commission, Seattle, Washington.*

RECORDS OF *CARCHARODON CARCHARIAS* (LINNAEUS) AND *PSEUDOPRIACANTHUS ALTUS* (GILL) FROM THE GULF OF MAINE, SUMMER OF 1937.—The capture of four white sharks, *Carcharodon carcharias,* within the Gulf of Maine the past summer is particularly noteworthy for not only is this the largest number ever to be reported from this region in one summer, but authentic records of this species in our northern waters are so few that scarcely a dozen fish have been reported during the past century. All four records were furnished by Mr. J. W. Lowes, of Harvard University, who harpooned the first shark on June 30 about three miles off North Truro beach, near Provincetown, Massachusetts. This fish was a male, 9 feet, 3 inches long. The stomach contained a 3-foot spiny dogfish bitten in two pieces and the head of a fish, unidentified. Most extraordinary was the presence of a large, heavy, wooden hoop which had wedged itself down as far as the pectoral fins, over the fifth gill slit, and had worn a deep groove in the shoulders of those fins and also on the back and belly. Mr. Lowes is of the opinion that the hoop may have come from a fyke net. Excellent photographs, and the jaws, were obtained.

The second capture was reported to Mr. Lowes by W. T. Reid, III, of Cohasset, who harpooned the fish about two miles off Nantasket Beach, Massachusetts, on July 25. It was a female, 7 feet long, with a girth of 4 feet. The teeth, tail, and fins were retained and the specimen was unquestionably a white shark. Some time later, about two miles further off shore than the preceding, Mr. Reid observed a much larger shark which might well have been of the same species, for the back was dark gray and large caudal keels were present.

The third fish, 6 feet, 8 inches long, with a girth of 3 feet, 2 inches, was taken about eight miles south of Wood End at Provincetown on August 29; while the fourth, 7 feet, 1 inch long, with a girth of 3 feet, 7 inches, was harpooned the next day by Mr. Lowes, about five miles south of Wood End. Both were females and neither was gravid.

A specimen of *Pseudopriacanthus altus,* 38 mm. long, was taken in a tide pool at Cohasset, Massachusetts, September 7, by Mr. F. G. Bemis, Jr., and sent to the Museum of Comparative Zoology, Cambridge, by Mr. B. Preston Clark. Although the young of this species are taken from time to time along the southern New England coast in summer, this is the first record noted from within the Gulf of Maine since the capture of a specimen on Marblehead Beach in September, 1859.—WILLIAM C. SCHROEDER, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

Herpetological Notes

ADDITIONS TO THE HERPETOLOGY OF MINNESOTA.—On September 18, 1936, the writer, accompanied by R. M. Berthel and Sterling Brackett, found the cricket frog, *Acris gryllus,* in considerable numbers in pools left by the recently swollen Rock River, near Luverne, in Rock County, and along a small tributary stream, in adjacent Nobles County, in extreme southwestern Minnesota. The species appears to be new to the state list. The occurrence of the cricket frog along this river might have been suspected from Over's records in the drainage areas of the Big Sioux, Vermillion, and the James rivers, in eastern South Dakota (Amphibians and Reptiles of South Dakota, 1933: 13).

The massasauga (*Sistrurus c. catenatus*) has been recorded from the Wisconsin side of the Mississippi River opposite the southeastern counties of Minnesota, but the species has not before been recorded from Minnesota. Messrs. Sterling Brackett, collecting for the University Museum, and Everett Lorenz, a local collector, secured a male specimen, measuring 419 mm., in the grassy bottom lands just below Wabasha, Wabasha Co., on June 15, 1936.

Specimens of *Bufo cognatus,* apparently not before recorded from the state, were found on August 20, 1936, by Mr. A. C. Hodson and Dr. C. E. Mickel of the Department of Entomology and Economic Zoology of the University of Minnesota, on the highway in Lincoln Co., Minnesota, near the South Dakota line. The heavy rains in southwestern Minnesota during 1937 brought out great numbers of toads, and thousands of them were killed on the gravelled and paved highways in this section. These crushed specimens soon dried and accumulated along the shoulders of the roads where they were collected and easily identified for several weeks after they had been killed. The results of two trips made by the writer supplemented by collections by local residents define the range of *B. cognatus* in this state fairly accurately. Specimens have been secured from the following southwestern counties: Nobles, Pipestone, Lincoln, Lyon, Yellow Medicine, Renville, Lac Qui Parle, Chippewa, Swift, Big Stone, Stevens, Pope, Traverse, and Grant. It is practically certain that the species also occurs in Rock, Murray, and Redwood counties.

The average length of 10 specimens taken during July and early August of this year is 41 mm., while the average of 10 taken in late August and September is 53 mm. These toads could scarcely have transformed this year, and still they were not large adults. In averaging the annual precipitation for 10 stations within the range of this toad in Minnesota, the following figures result:

1931	5.78 in. below normal	1934	5.25 in. below normal
1932	3.76 in. below normal	1935	1.02 in. *above* normal
1933	5.06 in. below normal	1936	6.55 in. below normal

I conclude that the moist season in 1935 resulted in a good hatch and successful metamorphosis, but the animals would have been too small to attract any general attention that year. In 1936 the extreme drought kept them dormant most of the time and little growth took place. Then this year the heavy rains brought out the small two-year-old toads which thrived on the abundant insect life and became very conspicuous.

Specimens of the cricket frog, the toad, and the single *Sistrurus* are preserved in the Museum of Natural History of the University of Minnesota.—W. J. Breckenridge, *Museum of Natural History, University of Minnesota, Minneapolis, Minnesota.*

OCCURRENCE OF THE RING-NECKED SNAKE IN THE STATE OF WASHINGTON.—Reporting on the reptiles of Whitman County, Washington, in 1933, Svihla and Svihla reported the first known occurrence of the ring-neck snake, *Diadophis amabilis occidentalis,* on the basis of a specimen from Wawawai, on the Snake River.

During the past year two additional specimens of *D. a. occidentalis* have been collected in Washington and presented to the Charles R. Conner Museum of the State College of Washington. One is from Colfax, Whitman County, in the eastern part of the state, and the other from Kalama, Cowlitz County, in the west. Thus the occurrence of this small reptile in the State of Washington is substantiated and its known distribution extended. It is hoped that further specimens of this snake will be brought to light.—Arthur Svihla, *State College of Washington, Pullman, Washington.*

AN ADDITION TO THE REPTILE FAUNA OF CALIFORNIA: *SONORA SEMIANNULATA*.—On Sunday, April 24, 1937, I was returning with Harold Woodall from a collecting trip to Death Valley by way of the Panamint Mountains and Darwin. While collecting on the sand dunes of the valley had been disappointingly poor, the rocky hillsides of the eastern slope of the Panamints were swarming with chuckwallas (*Sauromalus obesus*), collared lizards (*Crotaphytus collaris baileyi*) and other reptiles. Not far above the Emigrant Gap Ranger Station I discovered, about at noon, a small, brightly banded snake crawling in a very narrow crevice among the dark colored volcanic rock outcroppings. I managed to seize the very tip of its tail, and, with the aid of Mr. Woodall, extricated the snake after some difficulty. It was a typical specimen of *Sonora semiannulata*, marked with dark cross bands on light, reddish ground color. This constitutes, to the best of my knowledge, the first published record of typical *semiannulata* from the state of California. The so-called *Sonora episcopa*, which Klauber and others have reported repeatedly from California, is sometimes included in the synonymy of this species but differs sharply from the typical form by the lack of crossbands. The final status of this question will have to await Mr. Stickel's revision of the genus. The discovery of this snake in California is not surprising, since Van Denburgh reports a specimen from Rhyolite, Nevada, on the eastern side of Death Valley, close to the state line.

The live specimen was presented to Field Museum on occasion of a visit by Karl P. Schmidt. The data on it are as follows: total length 365 mm., tail 75 mm., ventrals 161 + 2, caudals 53 (second and third entire), scale rows 17–15–14.—WALTER MOSAUER, *University of California at Los Angeles, California.*

A LARGE CHORUS OF *HYLA GRATIOSA*.—While collecting at night, on April 19, 1937, about four miles east of Gainesville, Alachua County, Florida, Mr. H. K. Wallace and I located a small pond which teemed with *Hyla gratiosa*. In a short time we secured 165 specimens. We also took a large *Natrix s. pictiventris* which had five *gratiosa* in its mouth and stomach, all evidently just captured, as they were in a fresh condition, and two were still alive. This makes a total of 170 *H. gratiosa* taken at the time; 40 of these were females and 130 males. Most of the frogs were near the border of the pond but a few were out towards the center. We believe we captured about 90 per cent of the *gratiosa* which were in the pond at the time.

I returned later to measure the pond and found it to be elliptical in shape with a length of 100 feet and a width of 70 feet. This gives an area of approximately 5,500 square feet. As 170 frogs were taken, there was an average of one frog for each 32.3 square feet of water surface. The region in which the pond is located is well covered with vegetation. By far the most abundant tree in the region is *Quercus marilandica*, with *Q. virginiana, Q. rubra, Q. catesbaei, Pinus palustris*, and *Hicoria alba* also plentiful. *Liquidambar styraciflua* and *Nyssa acquatica* are found growing near the edges of most of the small ponds, which are numerous in the area, many with permanent water. The top soil is sandy and well drained.

One hundred of these specimens are now in the Carnegie Museum (Cat. No. 12,213). The remainder are deposited in the Department of Biology, University of Florida, Nos. 1,181 and 1,182).—COLEMAN J. GOIN, *Department of Biology, University of Florida, Gainesville, Florida.*

ADDITIONAL RECORDS OF *RANA SYLVATICA* IN ARKANSAS.—In a previous note (COPEIA, 1935: 100–101) I reported the collection of the first specimen of the wood frog, *Rana sylvatica* LeConte, known from Arkansas. In connection with field studies carried on in the interests of the University of Kansas, six additional specimens were collected in northwestern Arkansas and deposited in the Kansas University museum. On August 18, 1935, Eugene Davis and I secured a very small specimen three miles southwest of Winslow, Washington Co., at an elevation of about 2000 feet. On June 12, 1934, I caught two large adults in Harrigan Cave, one mile west of Winslow, and three days later collected two more in Watson Cave, about two miles southwest of Prairie Grove, in the same county. All four of the frogs taken from caves were well back in the

twilight zone and rather inactive. In both cases the two frogs were within a foot of one another. On July 13, 1934, I collected an adult specimen one mile west of Ozark, Franklin County. It was taken from a short horizontal mine shaft in a bluff overlooking the Arkansas River, at an elevation of about 450 feet. There were three or four of the frogs in this narrow shaft, but they were very active and I succeeded in securing only one specimen. This species has been observed breeding two miles southwest of Winslow in a small pool at an elevation of about 2200 feet.

These specimens would seem to indicate that the wood frog is not especially rare locally, and might, in fact, be expected anywhere in the western part of the state north of the Arkansas River, and probably west into Oklahoma.—JOHN D. BLACK, *Department of Zoology, University of Arkansas, Fayetteville, Arkansas.*

LAMPROPELTIS GETULUS NIGRA (YARROW) IN WEST VIRGINIA AND WESTERN TENNESSEE.—A specimen of *Lampropeltis getulus nigra* (Yarrow) in the Cornell University Museum (No. 1877), collected by Dr. W. J. Hamilton, Jr., in July, 1931, at Dutch Hollow, Kanawha County, West Virginia, extends the range of the subspecies eastward from Hanging Rock, Lawrence County, Ohio (Blanchard, Bull. U.S.N.M., 114, 1921: 48). Netting, (Ann. Carnegie Mus., 25, 1936: 77–82) has reviewed the distribution of *L. g. getulus,* and comments on the probable occurrence of *L. g. nigra* in West Virginia, but this is the first definite record for the latter in the state. I understand from Dr. A. H. Wright that it is on the basis of this specimen that Stejneger and Barbour (Check List N.A. Amphibians and Reptiles, third edition, 1933) included West Virginia in the range of *L. g. nigra.* The specimen is a female, 982 mm. long, with about 74 rather obscure crossbands.

Blanchard (Occ. Pap. Mus. Zool., Univ. Mich., 117, 1922: 11) assigned a king snake taken near Henry, Henry County, Tennessee, to *L. g. nigra,* and one taken by S. N. Rhoads, in 1895, at Samburg on Reelfoot Lake, Obion County, to *L. g. holbrooki.* He remarked that the latter specimen showed a distinct tendency toward *L. g. nigra,* and that Henry was close to, if not within, the area of intergradation between the two subspecies. Parker (Journ. Tenn. Acad. Sci., 12, 1937: 73) considers *L. g. nigra* to be the predominating subspecies in Weakly County, and Reelfoot Lake in the area of intergradation. In July, 1936, the writer took a specimen (C.U. Mus. No. 2131), three-fourths of a mile north of Glory Hole, Reelfoot Lake, which agrees with the characters given for *L. g. nigra.* It is a female, 925 mm. long, with approximately 66 faint crossbands. This is the westernmost record for the subspecies in the northern counties of Tennessee. Since *L. g. holbrooki* also is reported from the Reelfoot Lake region, the two subspecies probably intergrade in the bottomlands of the Mississippi River. —HAROLD TRAPIDO, *Cornell University, Ithaca, New York.*

ON THE SIZE OF *RANA SPHENOCEPHALA.*—In a recent paper on the status of the leopard frogs (Herpetologica, 1, 1937: 84–87), Mr. Carl F. Kauffeld says that *Rana brachycephala* attains a greater size than either *pipiens* or *sphenicephala.* Over most of its range I have no doubt that *sphenocephala* is relatively small. In the area west of the Myakka River on the west coast of Florida, however, *sphenocephala* attains a very large size. Specimens having a body length of four and one-half inches, measured from snout to anus, are quite common, and I have seen a few specimens with a body length of five inches. One of these weighed half a pound. In contrast, the specimens of *sphenocephala* found in the vicinity of Biloxi, Mississippi, rarely attain a body length of over three and one-half inches. Captive specimens of *sphenocephala* kept in a pen at Englewood, Florida, exhibit the lack of discrimination in feeding habits which characterizes big bullfrogs. Fiddler crabs and crayfish form the bulk of their diet and small toads and frogs are taken voraciously. These frogs successfully swallowed six (out of a batch of twenty-eight) week-old alligators placed in a pen with them.—STEWART SPRINGER, *Bass Biological Laboratory, Englewood, Florida.*

NOTES ON WRIGHT'S BULLFROG, *RANA HECKSCHERI* (WRIGHT).—*Rana heckscheri* is very common in the vicinity of Silver Springs, Florida, in the streams and rivers and in the lakes connected by streams which flow into the Oklawaha River. The night of June 8, 1936, I caught three mating pairs and transferred them to my private, twenty acre, grassy lake. About five thousand eggs were laid in masses, in shallow water, among the water grasses; they were hatched in ten to fifteen days into black tadpoles. About ten per cent of the eggs failed to hatch. From then until September the tadpoles grew rapidly, attaining the length of four to five inches. The color changed to a lighter hue and showed a speckled appearance; the tail was bordered with black The tadpoles stayed in shallow water and were always packed close together. They fed on meat thrown into the lake for the alligators, and seemed also to feed on plant life. Occasionally dead tadpoles were noted but I could not determine the cause of death.

The growth was slower during the cooler months but the tadpoles remained very active. Banded water snakes fed on them occasionally. Sometimes the tadpoles came into shallow water so that their backs were exposed, but at night they went back into deep water. They were always found on the same side of the lake within an area of fifty yards. By March, 1937, the hind legs appeared and growth was again noticeable. By April 1 the tadpoles were six to seven inches long and front legs appeared. On April 10 the transformation was well under way and the tadpoles were hopping out on the bank. During this time great numbers (about twenty per cent) died. By May 1 all had transformed, hopped out on the bank, and had scattered. On June 1, one was found hopping away about two hundred yards from the lake. Very few can be found now anywhere around the lake.—E. Ross Allen, *Silver Springs, Florida.*

THE COPPERHEAD IN NORTHERN FLORIDA.—The only reasonably authentic record of the occurrence of the copperhead (*Agkistrodon mokasen mokasen*) in Florida that I have been able to trace rests on a specimen in the U.S. National Museum, sent from Gainesville in 1889. I am indebted to Dr. Leonhard Stejneger for this information, and this specimen was evidently the reason for the inclusion of Florida in the range of the copperhead given in the "Check-list." In response to advertisement for additional specimens of this snake from the state, a great variety of snakes has been received at the Florida Reptile Institute, mostly baby moccasins, but no copperheads. A copperhead received from near Albany, Georgia, collected by Mr. H. C. Bierman, traces the range to a point 30 miles north of the Florida line. A trip to Chattahoochee, Gadsden County, following this lead, was made on October 6, 1937, in company with Carol Stryker and Bill Piper; we failed to discover any copperheads until, in conversation at dinner with an old friend, Mrs. C. A. Root, she mentioned that a snake had been killed during the day in front of her house. After some search, the specimen came to light, and proved to be the much desired copperhead. The specimen measures 570 mm., and has fifteen dark brown saddles.—E. Ross Allen, *Silver Springs, Florida.*

THE MILK SNAKES IN MINNESOTA.—On May 5, 1935, a collector brought to the writer two milk snakes, collected about one mile from Merriam Junction, Scott County, Minnesota. Both specimens were about two feet in length, one a male, the other a female, and when collected, were found within a few feet of each other. These specimens prove to be *Lampropeltis triangulum triangulum.*

During the past six years the writer has collected and examined many specimens of milk snakes from Minnesota, and has seen only the two specimens of *Lampropeltis t triangulum* mentioned. The subspecies *syspila* is fairly common; locality records are: Fort Snelling and Lake Minnetonka, Hennepin County; Anoka, Anoka County; near Wyoming, Chisago County; near St. Paul, Ramsey County; Red Wing and Cannon Falls, Goodhue County; Wabasha, Wabasha County; and Savage, Scott County. The specimens of *t. triangulum* and some of *t. syspila* are in my personal collection, while the remaining specimens are in the collection of the Natural History Museum at the University of Minnesota.—Rene B. Stiles, *Minneapolis, Minnesota.*

REVIEWS AND COMMENTS

GENETICS AND THE ORIGIN OF SPECIES. By Theodosius Dobzhansky. Columbia University Press, New York, 1937: i–xvi, 1–364, 22 figs.—Among the relict populations of systematists preserved by the museum environment from the competition, if not positive aggression, of the dominant experimentalists, there has been some legitimate concern lest their numbers decline to the point at which extinction becomes inevitable. Huxley's famous reference to the systematists as "Hod-carriers of science" (scarcely in character for him) seems to have been an early sign of an indifference toward systematic biology on the part of those engaged in the more experimental or more mathematical sciences, which has prevailed among university biologists for more than a generation.

A change in this attitude is beginning to make itself felt. A leader among the ecologists has frankly admitted that ecology tends to be parasitic on systematics. Experimental biology has found its way into at least one of the principal museums. The systematists themselves have been turning their attention to some of their fundamental concepts and principles (witness Dunn and Ginsburg in COPEIA). It is especially gratifying, therefore, to find one of the leaders among the modern geneticists expressing an active interest in systematics. In Dobzhansky's chapter headings appear such topics as "organic diversity," "racial and specific differences," "variation in natural populations," "selection," "isolating mechanisms," and "species as natural units," all of which are of first rate importance to systematic biology. The reviewer is not competent to discuss the genetics of this work, but he does find large sections of it intensely interesting to a practicing systematist. It is difficult to refrain from extensive quotation. The reconciliation of natural selection with mutation is well set forth (p. 150); and it is interesting to find that the variation of animals and plants in nature is found by geneticists, after an exhaustive survey of the problem, to be very exactly of the kind postulated by Darwin. The regularities in geographic variation, which the reviewer has recently discussed in "Ecological Animal Geography" appear here with comment from the geneticist's viewpoint.

Some of us may feel that Dobzhansky is inclined to expand the field of genetics to include practically all of biology, and that the important contributions of ecology and physiology are neglected; but this emphasis is at least forecast in the title of the book.

The work is admirable in typography and extremely free from typographic error; the reviewer notes only *"Ligula"* for *Lingula* (p. 37). The index is adequate, the bibliography strictly confined to recent work in genetics.—KARL P. SCHMIDT, *Field Museum of Natural History, Chicago, Illinois.*

A REVISION OF THE LAMPREY GENUS *ICHTHYOMYZON*. By Carl Hubbs and Milon B. Trautman. Misc. Publ. Mus. Zool., Univ. Michigan, No. 35, 109 pp., 22 tables, 1 map, 5 figs., 2 pls.; June 14, 1937.—This paper takes its place beside Hubbs and Cannon's 1935 revision of the darter genera *Hololepis* and *Villora*, as one of the very few fine, complete, modern revisions of groups of American fish-like vertebrates. Dr. Hubbs and Mr. Trautman demonstrate that instead of two, there are six species of *Ichthyomyzon*, three parasitic and three non-parasitic, and that each of the non-parasitic forms appears to have arisen independently from a different one of the three parasitic ones. The reviewer feels it useless to do more than to direct the attention of American students of fishes to the manner in which Dr. Hubbs and Mr. Trautman have attacked this puzzling group; it provides a lesson in ichthyography, including both examination of material and use of the literature that some workers sorely need.

The illustrations of the disks of the larger species (on plate 2) are fair, but would have been greatly clarified by outlining the important characters with India ink; those of the smaller forms are too small and indistinct to be of great use. Good, enlarged drawings of all would have been clearer and of more help.—GEORGE S. MYERS, *Stanford University, California.*

OYSTER BIOLOGY AND OYSTER-CULTURE, being the Buckland Lectures for 1935. By J. H. Orton. Edward Arnold & Co., London, 1937: 1-211, figs. 1-57.—Modern oyster-culture has greatly benefited by the application of scientific methods. The number of special investigations in this field in England, France, the United States, Norway, Japan and other countries, has made it well nigh impossible for anyone but a specialist in that field to appreciate fully the advances made and the problems to be solved. Consequently, we are fortunate in now having available Professor Orton's *Oyster Biology and Oyster Culture*. This book contains an immense amount of data which is not only written so as to be of interest and value to the layman, but it might also be read with profit by specialists in the field.

The contents of the book have been taken from the Buckland Lectures delivered in 1935. Fortunately, many of the figures have been included in the publication. The book is divided into two parts. The first deals with the natural history of the European oyster. Many interesting phases are discussed, such as: the adjustment of the oyster to the temperature of the water in which it lives; its method of propagation, method of feeding and the seasonal changes which, through the delicate temperature control, affect the processes of feeding, growth and breeding. The second part presents some of the problems relating to oyster culture. Emphasis is placed on the importance of the relationship of the oyster to its environment. The environment best suited to it is carefully analyzed, and this analysis permits the introduction of some of the many problems which confront the biologist and the industry.—HENRY VAN DER SCHALIE, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

THE BIOLOGICAL CONTROL OF INSECTS, WITH A CHAPTER ON WEED CONTROL. By Harvey L. Sweetman, with a foreword by L. O. Howard. Comstock Publishing Co., Ithaca, N.Y., 1936: i-xii, 1-461, 142 text figs. $3.75.—One of the most interesting commercial uses of fishes, and not the least valuable, has been in the control of mosquitoes by cyprinodont fishes. In *The Biological Control of Insects*, Harvey Sweetman presents a brief section on this subject, setting forth the most suitable species for insecticidal use, their distribution, the methods of shipping and successfully introducing them. This is the best exposition of mosquito control by fishes in current print. There are also brief sections on amphibians and reptiles as insect predators. Although these are the parts of the work that will be of greatest interest to ichthyologists and herpetologists, it is unlikely that those readers will want to stop there, for the balance of the book is a fascinating array of practical information on the use of all kinds of animals in insect control.—L. A. WALFORD, *Jordan Hall, Stanford University, California.*

THE SMALL-MOUTHED BASS. By Carl L. Hubbs and Reeve M. Bailey. Cranbrook Institute of Science, Bloomfield Hills, Michigan, Bulletin No. 10, January, 1938; 1–89, 5 text figs, frontisp. drawing, 9 plates. $0.75.—This is a valuable contribution to the study of a most popular game fish, both for sportsmen and for those engaged in conservation and fisheries research, bringing together most of the literature to date on the subject. It contains a good outline of the classificatory characters of the sunfish family, as well as a key for the identification of the black basses, anatomical diagrams and descriptions, and a glossary. The account of the distribution of the small-mouthed bass in North America, with a partial history of the extension of its range by human agencies, is enriched with some detail of the habitat requirements of young and adults. Sections of the book deal with reproduction, with growth and food in different parts of the range of the bass; with the harmful effects of the bass tapeworm, both on growth and reproduction; also, for fishes in general, with the senses of taste, smell, mass movement, hearing, touch, sight, and the ability to learn. There are further chapters on angling and artificial culture, on the causes of depletion, the problems of optimum yield, protection during spawning, efficacy of minimum size limits, sanctuaries, floods, lake and stream improvement and other important phases of a well rounded fishery project. The continual use of such words as "probably" emphasizes the fact that much work remains yet to be done on the biology of this important species. A bibliography of 63 publications by 45 authors is included.—K. H. DOAN, *Ontario Fisheries Research Laboratory, University of Toronto, Toronto, Ontario.*

PONDFISH CULTURE. A HANDBOOK ON THE CULTURE OF WARM WATER GAME FISHES OF THE UNITED STATES. By Percy Viosca, Jr. Pelican Publishing Co., New Orleans, 1937: i-xxiii, 1-260, 68 text figs. $4.00.—This is a compilation of current conceptions of the elements which govern the productivity, in terms of Centrarchid fishes, of static water areas; and there is outlined the technique whereby these factors may be influenced to augment the productivity.

The contents include a rather casual synopsis of the Centrarchids most amenable to hatchery culture. Pond construction and other mechanical processes are covered in reasonably adequate detail. In one section you may learn practically painlessly of the most important natural food organisms, and how to cultivate them. It is extremely useful to have at hand citations of maximum, minimum and average end products of the aquatic food cycle under varying conditions for different species.

Mr. Viosca presents a rather philosophic discussion of management and stocking policies for interior waters, and here is debatable material; in fact many people will be able to cite their own experiences and observations in contravention to some of Mr. Viosca's conclusions. Furthermore, some readers may hold that there is inadequate treatment of recent developments in the artificial feeding of bass, sunfish, etc.

The author has drawn liberally upon the findings of other investigators, and variation of opinion upon minor points need not detract from the broader value of the work. The author's methods of pond culture have been worked out largely in the south, and it remains to be seen whether the modifications he suggests for northern conditions will compensate for marked difference in environmental elements.

A number of line drawings and photographs are given, illustrating practical details of mechanics and engineering, as well as the species covered. The bibliography seems woefully incomplete, considering that the work is based upon highly diverse source material.

This reviewer is glad that Mr. Viosca has produced *Pondfish Culture*. He has done for the warm water fishes what Thaddeus Norris and Livingstone Stone did for the trouts over 50 years ago. The publication is much broader in scope than Lydell's works. And if a text book in this particular field is needed, this volume is it until something better comes along.—M. C. JAMES, *United States Bureau of Fisheries, Washington, D.C.*

FISH AND FIND OUT. By Major R. C. Simpson. A. and C. Black, London, 1937: xii, 1-220, 10 drawings. $7.00. This is a casually written, conversational piece about fly fishing in the British Isles calculated to stir up a pleasant glow of memories, and perhaps also to suggest a few refinements in fishing techniques. It offers nothing new to the average angler, except a number of anecdotes, which, being British, will prove puzzling to American readers.—L. A. WALFORD, *Jordan Hall, Stanford University, California.*

EDITORIAL NOTES AND NEWS

Letter to the Editors

CALIFORNIA is to be the 1938 "guinea pig" of the antivivisectionists—and your state may be next. California antivivisectionists are actively backed by interested national organizations in their efforts to put through the so-called "State Humane Pound Law" initiative at the election next November.

Legal interpretation of this apparently bland measure indicates that its passage and enforcement would make next to impossible the acquisition of animals for any scientific or commercial purpose. This would tremendously cripple medical and biological research and teaching, and would make extremely difficult the production of vaccines, serums anc antitoxins in California. Passage of this measure would admittedly be followed by vigorous campaigns for similar legislation elsewhere. California is to be the testing ground for the nation.

Defeat of this initiative becomes the active concern of scientifically educated and well-balanced citizens all over the United States. There is definite cause for alarm among the far-sighted. When serums and vaccines are difficult or impossible to obtain, the health and lives of all of us are menaced—and even the health and lives of the very animals presumably "protected" by such a measure. Medical science and the biological sciences have much to teach now, and even more yet to learn, about the life processes. Must the life sciences be taught in part only, and with no new contributions from whole fields of science? Must our future citizens, because of the misguided efforts of sentimentalists, leave school with blind spots in their education and outlook—with no laboratory knowledge of how the wheels go round and why?

We must at all costs prevent a return to the dark ages of biology and medicine—to the times when advance in knowledge was based, without benefit of observed facts, solely upon a study of the theories of long dead predecessors. The brilliant progress of our physiologists, psychologists, geneticists, and embryologists must not be checked by the unreasoning and the unreasonable. Our physicians, surgeons, dentists, and veterinarians must not start practice without adequate training and preparation.

Scientific organizations on the West Coast are aroused over this latest menace, and are cooperating fully with the California Society for the Promotion of Medical Research, for they realize that biology will be hit as hard as medicine. Every effort will be made to combat this legislation. But the destructive plans of inimical forces have been carefully laid, and their propaganda is insidious. Public opinion is being deflected from the true point at issue by appeals to the heart. The people of California will vote upon this directly—not the Legislature, as heretofore. It is going to be a close battle. Biologists, medical men and intelligent, informed laymen—we are all involved, directly or indirectly, and we must work together.

Members of the Western Division of the American Society of Ichthyologists and Herpetologists will take an active part in this campaign. We urge our colleagues throughout the nation to realize the gravity of the situation, and to spread everywhere the news of this latest threat to the freedom and progress of modern science.

We need an avalanche of protest reaching into California by informed citizens in all parts of the country. We urgently request of you strong expressions of amazement and alarm at the long step backward that California is asked to take. We will use them where they will do the most good. Such vigorous protests will be read at the spring and summer meetings of organizations on the West Coast, and issued in campaign publicity, so that Californians will realize how the rest of the country feels.

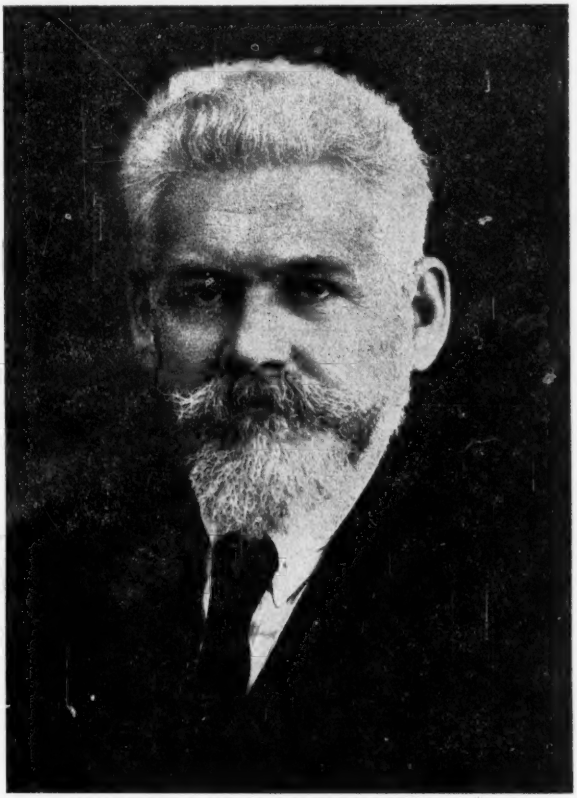
Write us today and thus give us your positive support. Address letters or postcards to the Secretary-Treasurer, Miss Margaret Storey, Box 1606, Stanford University, California. Your names will be omitted if desired.—MAJOR CHAPMAN GRANT, *President Western Division, American Society of Ichthyologists and Herpetologists.*

Aid to Copeia

FINANCIAL aid in the publishing of this issue of COPEIA has been received from PRINCETON UNIVERSITY MUSEUM.

Leo S. Berg

DR. LEO S. BERG, Academy of Sciences, Leningrad, U.S.S.R., was elected Honorary Foreign Member of the Society in 1937. It is rare indeed to encounter a man whose abilities and industry permit him to encompass successfully as wide a field as is covered by the researches of Dr. Berg. Able teacher beloved by his many students, generally esteemed and admired, this brilliant systematist is the author of monographic revisions of nearly all the fresh-water fishes of the U.S.S.R. Among the best known of his works are the classic *Freshwater Fishes of*



the U.S.S.R. and the volumes on "Fishes" in the series *Fauna of the U.S.S.R. and Adjacent Lands;* but his long list of publications of the past forty-some years includes studies on life zones, zoogeographical distribution, the biology of fishes, and the history of explorations in the Pacific. His latest important contributions include the sections on "Life Zones," "Pisces," and "Acrania" in the *Animal World of the U.S.S.R.*, a book on *The Discovery of Kamchatka and the Expeditions of Bering*, and a *Classification of Fishes*, embracing the major groups of all known living and fossil fishes.—LEO SHAPOVALOV, *Museum of Natural History, Stanford University, California.*

Endowment Fund News

THE following persons have become complete or partial Life Members since the first names were announced in COPEIA: JOHN W. BAILEY, WILLIAM T. BROUGHMAN, CHARLES E. BURT, L. M. KLAUBER, E. A. MCILHENNY, J. T. NICHOLS, K. P. SCHMIDT and F. H. STOYE. The total sum on deposit in the Endowment Fund is $790.38.

News Items

MARGARET STOREY has been appointed on the Council of the Pacific Division of the American Association for the Advancement of Science as representative of the Western Division of the American Society of Ichthyologists and Herpetologists and co-representative of the Western Society of Naturalists.

GEORGE S. MYERS sailed on January 3 with Captain G. Allen Hancock for a two months expedition along the Pacific Coast to Ecuador and Peru.

The WOODS HOLE OCEANOGRAPHIC INSTITUTION has assigned the *Atlantis* to make a detailed study of littoral and deep sea fishes around the Cuban coast, the voyage to be under the joint auspices of the University of Havana and Harvard University, both institutions having contributed toward the cost of the trip.

The vessel is now en route to Havana with W. C. SCHROEDER, Associate Curator of Fishes of the Museum of Comparative Zoology. In Havana, he will be joined by DR. GUILLERMO AGUAYO, DR. LUIS HOWELL RIVERO and DR. PEDRO BERMUDEZ, all of whom have studied at Harvard University as John Simon Guggenheim Fellows and who are now connected with the Biological Department of the University of Havana.

L. C. STUART left late in February for Guatemala. Dr. Stuart will make field studies for several months of the herpetological fauna in the vicinity of Coban for the Museum of Zoology, University of Michigan.

E. GUSTAV FALCK has been appointed Curator of Reptiles in the Lincoln Park Zoo, Chicago.

Annual Meeting

THE 1938 annual meeting of the Society will be held at the University of California, Berkeley, from Tuesday, July 19, to Saturday, July 23. The American Society of Mammalogists will meet there at the same time. Members who expect to take part in the program should notify the local committee as soon as possible. Inquiries concerning the meeting should be sent to the Secretary, Mr. Netting, or to any member of the local committee: Jean M. Linsdale, Chairman, Museum of Vertebrate Zoology, Berkeley, C. L. Camp, W. I. Follett, G. S. Myers, Miss M. Storey, and A. C. Taft.

Recent Deaths

DR. NICHOLAS A. BORODIN, Curator of Fishes Emeritus at the Harvard Museum of Comparative Zoology, died at Cambridge, Massachusetts, on December 22, 1937, after a brief illness.

Dr. Borodin was born in Uralsk, Russia, November 23, 1866. He received his doctorate degree from the University of St. Petersburg in 1889, when he became District Fish Commissioner for Uralsk. Later he was Chief Specialist in Fish Culture in the Department of Agriculture, and Professor in the Petrograd Agricultural College. In 1917 he was named special delegate to this country by the provisional Kerensky government, and in 1918 he was Vice-President of the Scientific Agricultural Council of the Kolchak Government of Omsk in Siberia, which he represented on a scientific commission to the United States. When the Kolchak government collapsed, he became a political exile in this country. Here he became Assistant Curator in the Brooklyn Museum of Arts and Science (1926-27), Assistant in the American Museum of Natural History (1927-28), and then Curator of Fishes in the Museum of Comparative Zoology. He was a member of the American Society of Ichthyologists and Herpetologists, an honorary member of the American Fisheries Society and the Société d'Aquiculture et de Pêche.

Requests

PROFESSOR B. S. ILYIN, Pyatnitzkaya Street 33, qu. 15, Moscow 17, U.S.S.R., would be pleased to receive all literature on methods and technique of ecological experiments with fish, especially that of the past ten years. He is also interested in contemporary experimental aquaria.

R. GORDON FAUDREE announces the organization of the Dayton Zoological Society, consisting of a group of people interested in forming a collection of animals, especially reptiles, as a center of study. Mr. Faudree will appreciate donations of animals from scientific institutions and museums, and wishes to receive price-lists of animals from dealers. His address is 140 Englewood Road, Springfield, Ohio.

The volume on reptiles and amphibians in the natural history series sponsored by the FEDERAL WRITERS' PROJECT is near completion. RALPH DE SOLA, zoological editor, is anxious to secure the loan of pictures of reptiles and amphibians for use in this volume, more especially portrait studies of live specimens, habitat scenes, and photographic sequences of life histories. These will be handled with the greatest care, quickly copied and returned. The address is 235 East 42nd St., New York City.

COPEIA IS THE JOURNAL OF THE AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS

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Manuscripts, news items, and all correspondence regarding the Journal, should be addressed to one of the Editors.

Manuscripts should be submitted on good paper, as original typewritten copy, double-spaced, carefully corrected. Galley proof will be furnished authors.

Original contributions, not to be published elsewhere, are alone acceptable.

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Figures, author's corrections, expensive tabular matter and unusually long articles may be charged in whole or in part to the author, at the discretion of the Editors.

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ΕΡΠΕΤΟΝ